

---

Vol. XXXIII JANUARY-FEBRUARY-MARCH, 1950 No. 3

---

# THE PHILIPPINE AGRICULTURIST

---

UNIVERSITY OF THE PHILIPPINES PUBLICATIONS SERIES A

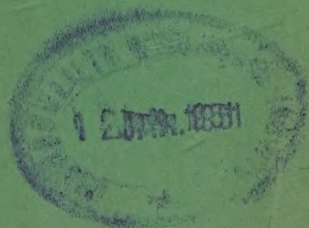
---

## CONTENTS

- The Growth and Development of Some Pure Breed and Grade Calves.....** *By Remberto Z. Ver....* 149
- Behavior of Five Brazilian Rice Varieties Under Lowland Culture in the College of Agriculture.....** *By José M. Capinpin and Teodomero M. Yñiguez.....* 166
- An Outstanding Introduced Variety of Sugar Cane....** *By Valeriano C. Calma and Federico V. Ramos* 190
- The Use of Sun Porch for Laying Pullets.....** *By Amado C. Campos...*  197
- The Food Supply and Population of the Philippines....** *By Francisco M. Sacay..*  203
- College and Alumni Notes.....** 218

*Published by*

THE COLLEGE OF AGRICULTURE  
UNIVERSITY OF THE PHILIPPINES



# The Philippine Agriculturist

(University of the Philippines Publications Series A)

---

## Editor

L. B. UICHANCO, SC.D.....*Dean, College of Agriculture*

## Managing Editor

G. O. OCFEMIA, PH.D.....*Professor of Plant Pathology*

## Copy Editor

MELANIO A. GAPUD, B.S.E.....*Assistant Professor of Agricultural Education*

## Editorial Assistants

NELLY DUNGLAO, B.S.E.....*Instructor in English*

TERESITA L. PRONOVE, B.S.E.....*Instructor in the Rural High School*

## Business Manager

JOSE M. CAPINPIN, PH.D.....*Associate Professor of Agricultural Botany*

## Advisory Board

R. B. ESPINO, PH.D.....*Head, Department of Agricultural Botany*

F. O. SANTOS, PH.D.....*Head, Department of Agricultural Chemistry*

VALENTE VILLEGAS, PH.D.....*Head, Department of Animal Husbandry*

FRANCISCO M. SACAY, PH.D.....*Head, Department of Agricultural Education*

LEON G. GONZALEZ, PH.D.....*Head, Department of Agronomy*

A. B. CATAMBAY, M.S.....*Head, Department of Agricultural Engineering*

SILVERIO M. CENDAÑA, PH.D.....*Assistant Head, Department of Entomology*

NICOLAS L. GALVEZ, PH.D.....*Acting Head, Department of Soils*

---

Authors of articles appearing in THE PHILIPPINE AGRICULTURIST are severally responsible for the opinions expressed therein.

---

THE PHILIPPINE AGRICULTURIST is published quarterly, beginning with Volume 31, by the College of Agriculture, University of the Philippines, Los Baños, Laguna. The subscription price is ₱6.00 a year in the Philippines and \$4.00 (U.S. currency) elsewhere; the price of single copies, ₱2.00 in the Philippines and \$1.00 (U.S. currency) elsewhere.

Business correspondence should be addressed to the Business Manager, THE PHILIPPINE AGRICULTURIST, College, Laguna, Philippines. All remittances should be made payable to THE PHILIPPINE AGRICULTURIST.

Communications for the editor should be addressed to the Editor, THE PHILIPPINE AGRICULTURIST, College, Laguna, Philippines.

---

Publications sent in exchange for THE PHILIPPINE AGRICULTURIST should be addressed: Library, College of Agriculture, College, Laguna, Philippines.

---

Entered at the Post Office at College, Laguna, Philippines, as second-class mail matter

## THE GROWTH AND DEVELOPMENT OF SOME PURE BREED AND GRADE CALVES<sup>1</sup>

REMBERTO Z. VER<sup>2</sup>

This progress report of the work which was under way for 14 years was prepared in 1938. It had for its aims, to study (a) the rate of growth and development of the various pure breed and grade cattle, (b) the possibilities of improving the size of the native cattle through infusion of foreign blood, (c) the kind and amount of foreign blood necessary for optimum results, and (d) the relation between the weight at birth and the weight at maturity of an animal. These series of studies were initiated by President B. M. Gonzalez when he was professor and head of the Department of Animal Husbandry and dean of the College of Agriculture as a stepping stone toward a more important aim—forming a new breed of cattle which possesses a better conformation and size than the native, reproduces regularly and grows economically under Philippine conditions.

The present study was carried out in the Department of Animal Husbandry of this College, from December, 1935, to November, 1937, as a continuation of the series which had begun with the work of Tuason,<sup>3</sup> from October 27 to December, 1923, and from March 21, 1924, to February, 1926; followed in order by Pepito,<sup>4</sup> from March, 1926, to December 31, 1927; by Agudo,<sup>5</sup> from January, 1928, to December 31, 1929; by Carambas,<sup>6</sup> from January, 1930, to November 30, 1932; and by Laher,<sup>7</sup> from December, 1932, to October 31, 1933. After an interruption of seven months, the work was resumed from June, 1934, to November 30, 1935.

### *Review of literature*

Eckles and Swett (1918) concluded that the growth of animals is measured by the gain in live weight and by the increase in height at withers.

<sup>1</sup>Experiment Station Contribution No. 1541. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, March, 1938. Prepared in the Department of Animal Husbandry under the direction of Assistant Professor F. B. Sarao.

<sup>2</sup>Deceased

<sup>3</sup>TUASON, C. S. A comparative study of the growth and development of some pure breed and grade calves. (Thesis presented for graduation from the College of Agriculture. 1926. Unpublished).

<sup>4</sup>PEPITO, T. H. A comparative study of the growth and development of some pure breed and grade calves. (Thesis presented for graduation from the College of Agriculture. 1928. Unpublished).

<sup>5</sup>AGUDO, E. A. A comparative study of the growth and development of some pure breed and grade calves. (Thesis presented for graduation from the College of Agriculture. 1930. Unpublished).

<sup>6</sup>CARAMBAS, P. A. A comparative study of the growth and development of some pure breed and grade calves. (Thesis presented for graduation from the College of Agriculture. 1932. Unpublished).

<sup>7</sup>LAHER, R. A. A comparative study of the growth and development of some pure breed and grade calves. (Thesis presented for graduation from the College of Agriculture. 1937. Unpublished).

THE PHILIPPINE AGRICULTURIST, VOL. 33, NO. 3, JANUARY, FEBRUARY, MARCH, 1950.

They found little relation between the size of the calf at birth and the rate of growth or the size of the animal at maturity. With regard to age, the heifers of the Holstein and Jersey breeds show well-marked breed characteristics at maturity. The Jersey reaches maturity in skeletal growth in three to four years and the Holstein, in four to five years. These authors further stated that both breeds reach the maximum weight about two years after the skeleton has ceased to grow.

Eckles (1919) concluded that breed is the most important factor influencing the weight of calves at birth. He also observed that when both sire and dam are of the same breed, the sire has but little influence upon the size of the calf at birth. In crossbreeds, however, the influence of the sire is evident.

Moulton, Trowbridge, and Haigh (1921) found, on the one hand, that animals fed full from birth had more rapid growth at earlier ages but much slower at later ages. On the other hand, scantily fed animals grow less rapidly in all respects.

After ten years of work with 1,000 breeding animals in Missouri, Burch, Sheets, Water, and Trowbridge (1926) concluded that the greatest single step toward improved quality occurs in the first cross; subsequent crosses increase quality value in a less marked degree. In the third or fourth cross, the offspring often compares favorably with the purebred stock in conformation, and only exceptionally good sires can bring further improvement. Early maturity is a conspicuous result of beef cattle improvement through the use of purebred sires.

Lush (1928) improved the size, resistance to pests and the ability to fatten on the range of the native cattle of the coastal plain of Texas by using Brahman or Indian bulls. He observed that as the blood of the Brahman was increased, the wildness and pugnacity of the animals were also increased. Lush, Jones, Demeron, and Carpenter (1930) noted that in Texas, quarter-blood Brahman are slightly heavier than half-blood Brahman or high-grade Herefords.

From 1912 to 1931, Espe, Cannon, and Hanson (1932) worked on 262 purebred dairy females of Ayrshires, Guernseys, Holsteins, and Jerseys and found that the male calves of all the breeds weighed more at birth than the female. The mature growth values are approached most rapidly in height at the withers. This measurement is not even doubled from birth to maturity.

#### *Materials and methods*

A total of 212 animals was used in the experiment, of which 99 were males and 113 females. Forty-two animals died during the progress of the experiment, and 73 were either butchered or sold on the hoof. Of the 99 males, 24 were castrated, 22 were broken for work, and 2 were dehorned. Of the 113 females, 57 had dropped calves at least once and 20 were spayed. On November 30, 1937, there were 27 males and 33 females five years old or over.

The experimental animals were grouped according to their blood composition as follows:

Group	I.	Native.....	n
Group	II.	Nellore.....	N
Group	III.	Hereford.....	H

Group	IV.	1/2 Nellore - 1/2 Native	1/2 N - 1/2 n
Group	V.	1/2 Hereford - 1/2 Native	1/2 H - 1/2 n
Group	VI.	1/2 Hereford - 1/2 Nellore	1/2 H - 1/2 N
Group	VII.	3/4 Nellore - 1/4 Native	3/4 N - 1/4 n
Group	VIII.	1/2 Hereford - 1/4 Nellore - 1/4 Native	1/2 H - 1/4 N - 1/4 n
Group	IX.	3/4 Hereford - 1/8 Nellore - 1/8 Native	3/4 H - 1/8 N - 1/8 n
Group	X.	1/4 Hereford - 1/2 Nellore - 1/4 Native	1/4 H - 1/2 N - 1/4 n
Group	XI.	1/4 Hereford - 5/8 Nellore - 1/8 Native	1/4 H - 5/8 N - 1/8 n
Group	XII.	Foundation stock of the Philamin	
Group	XIII.	F <sub>1</sub> Philamin	
Group	XIV.	F <sub>2</sub> Philamin	
Group	XV.	Philamin backcrosses. This group included animals with the Philamin blood but which were not strictly F <sub>1</sub> nor F <sub>2</sub> .	

From birth until the age of 6 months, the calves and their respective dams were weighed weekly; thereafter, they were weighed monthly.

Immediately after weighing, they were measured while they stood squarely on all four legs on a level floor. The calves were measured weekly from birth to the age of 6 months, and monthly thereafter.

Nine measurements were made in centimeters. The height at withers, height at top of the loin, depth of chest, and length of body from shoulder to ischium were measured with a wooden caliper; the width of hips, length of rump, and distance between thurls, with a wooden compass; the body circumference at heart girth and at belly, with a steel tape.

Gonzalez' (1924) "New Methods of Selecting Farm Animals" was followed in comparing the growth and development of the different groups. The animals to be compared were reduced to a common age basis, making it possible to compare young animals with older ones.

Eckles (1920) describes two ways of getting data concerning the normal growth of animals. One involves taking single measurements of heights and weights from a very large number of animals, and from these data, to construct a mean that would fairly represent the group. The second plan was to gather a large amount of data from a smaller number of animals by taking the weights and measurements at monthly intervals from birth to maturity.

Owing to the limited number of animals available for this work, the writer followed Eckles' (1920) second method.

Although different parts of the animal's body were measured, only three, the height at withers, heart girth, and length of body from shoulder to ischium, were considered in connection with the growth in weight.

## RESULTS AND DISCUSSION

### *Weight at birth*

Of the male calves, the  $\frac{1}{4}$  H -  $\frac{5}{8}$  N -  $\frac{1}{8}$  n were the heaviest at birth and of the Nellore, the  $\frac{1}{4}$  H -  $\frac{1}{2}$  N -  $\frac{1}{4}$  n, the  $\frac{3}{4}$  H -  $\frac{1}{8}$  N -  $\frac{1}{8}$  n, and the  $\frac{1}{2}$  H -  $\frac{1}{2}$  N followed. The Hereford and the Native were the lightest.

The Nellore female was the heaviest at birth; the  $\frac{3}{4}$  H -  $\frac{1}{8}$  N -  $\frac{1}{8}$  n, next; the Native, last.

When the birth weight of the males and females of the same blood composition was compared, the males were found to be heavier than the females in 12 out of 15 groups. Owing perhaps to the paucity and inadaptability of the purebred Herefords in the group, the females were slightly heavier than the males. Likewise, owing perhaps to the less number of F<sub>2</sub> Philamin, both males and females were more or less equal in birth weights. The females and males of all the Nellore grades were lighter at birth than the Nellore, except the males of the  $\frac{1}{4}$  H- $\frac{5}{8}$  N- $\frac{1}{8}$  n. The males and females of all the Hereford grades were heavier at birth than the Hereford, except the females of the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n. Both sexes of the Native grades had much heavier birth weights than the pure Native. The averages of the weights at birth of the different groups were 22.35 kgm. for the males and 21.07 kgm. for the females.

*The growth in body weight*

*The pure breeds.* The male Nellore was consistently heavier than the male of either the Hereford or the Native. Although the birth weights of the Hereford calves were less than those of the Native, the former became heavier than the latter in two months. After that, the Native again showed consistent advantage in weight over the Hereford. The Nellore maintained its lead from birth to maturity. The differences in weight between the Nellore and the other two breeds increased regularly up to maturity. At the age of 36 months, the Nellore male weighed 360.00 kgm.; the Native, 282.27 kgm.; and the Hereford, 218.00 kgm. The Native male was 77.73 kgm., and the Hereford, 141.60 kgm. lighter than the Nellore. At the age of 4 years, the Nellore male weighed 430.55 kgm. and the Native, 301.14 kgm. No male Hereford lived over 40 months.

From 1 to 4 months of age the Hereford female was heavier than the Nellore. At 5 months of age, the Nellore weighed 89.88 kgm. and the Hereford, 88.45 kgm. However, at the age of 6 months, the Hereford was heavier than the Nellore by 0.73 kgm. From 6 months to maturity the Nellore was heavier than either the Hereford or the Native. This advantage was not so great in the female as in the male. At the age of 36 months, the Nellore female weighed 302.31 kgm.; the Hereford, 252.50 kgm.; and the Native, 237.64 kgm.

*The Native and Native grades.* The male of the Native was inferior to any of its grades. The only time the male native weighed more than the  $\frac{1}{2}$  n- $\frac{1}{2}$  N was at the age of 4 to 15 months; than that of the  $\frac{1}{2}$  n- $\frac{1}{2}$  H, at 1 month and again at 4 to 15 months; and than that of the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N, at 21 to 27 months.

After 12 months, the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N was the heaviest. At birth, the  $\frac{1}{8}$  n- $\frac{1}{4}$  H- $\frac{5}{8}$  N Native grade was the heaviest. At the age of 6 months, the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N of 121.86 kgm. and the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N of 121.54 kgm. were the heaviest. At the age of 48 months, the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N weighed 463.02 kgm., or 161.88 kgm. heavier than the Native, 51.17 kgm. heavier than the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N, 76.86 kgm. heavier than the  $\frac{1}{4}$  n- $\frac{3}{4}$  N, 79.13 kgm. heavier than the  $\frac{1}{2}$  n- $\frac{1}{2}$  H, 91.08 kgm. heavier than the  $\frac{1}{8}$  n- $\frac{1}{4}$  H- $\frac{5}{8}$  N, 103.03 kgm. heavier than the  $\frac{1}{2}$  n- $\frac{1}{2}$  N, and 127.37 kgm. heavier than the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N.

The excess in weight over the Native of the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N was 53.76 per cent; of the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N, 36.77 per cent; of the  $\frac{1}{4}$  n- $\frac{3}{4}$  N, 28.23 per cent; of the  $\frac{1}{2}$  n- $\frac{1}{2}$  H, 27.48 per cent; of the  $\frac{1}{8}$  n- $\frac{1}{4}$  H- $\frac{5}{8}$  N, 23.51 per cent; of the  $\frac{1}{2}$  n- $\frac{1}{2}$  N, 19.55 per cent; and of the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N, 11.46 per cent.

The female Native was lighter than most of the grades; its weight at birth was exceeded by all the grades. From birth to 12 months of age, the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N had the most conspicuous growth, but it was outstripped by the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N from the age of 12 months to maturity.

After 15 months, the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N surpassed the rest of the grades, except at 42 months of age when the  $\frac{1}{8}$  n- $\frac{1}{4}$  H- $\frac{5}{8}$  N was the heaviest.

At the age of 36 months, all the Native grades, except the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N and  $\frac{1}{4}$  n- $\frac{3}{4}$  N, showed marked superiority over the Native. In general, the female Native grades excelled the pure Native females though in a lesser degree than the males.

*The Nellore and Nellore grades.* The Nellore male was heavier than its grades at 9 to 15 months of age. At 21 months of age, the  $\frac{1}{2}$  N- $\frac{1}{2}$  H and the  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n were heavier than the Nellore. From birth to 36 months of age, the  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n male was heavier than the  $\frac{1}{2}$  N- $\frac{1}{2}$  H. Thereafter and up to maturity, the  $\frac{1}{2}$  N- $\frac{1}{2}$  H was heavier than the  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n.

At the age of 60 months, the  $\frac{1}{2}$  N- $\frac{1}{2}$  H males weighed 520.12 kgm.; the  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n, 460.21 kgm.; and the pure Nellore, 439.66 kgm.

Like the male, the Nellore female weighed more or less intermediate among those of its grades. From 1 month to about 9 months of age, the heaviest was the  $\frac{1}{8}$  N- $\frac{3}{4}$  H- $\frac{1}{8}$  n; and from nine months to 36 months, the  $\frac{1}{2}$  N- $\frac{1}{2}$  H. After 36 months, the  $\frac{1}{2}$  N- $\frac{1}{2}$  H, the Nellore, and the  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n had about the same weight.

*The Hereford and Hereford grades.* The pure Hereford was the lightest of all the males in this group, although at 1 to 2 months of age it was a little heavier than the  $\frac{1}{2}$  H- $\frac{1}{2}$  n. From the age of 2 months, its rate of growth was slower than that of the rest.

The  $\frac{1}{4}$  H- $\frac{5}{8}$  N- $\frac{1}{8}$  n was the heaviest from birth to 1 month; the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n, from 1 to 4 months of age. From 12 to 36 months, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was the heaviest of all the grades, though from 36 months to maturity, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N became the heaviest.

At the age of 60 months, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N weighed 520.12 kgm.; the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, 460.21 kgm.; and the  $\frac{1}{4}$  H- $\frac{1}{2}$  N- $\frac{1}{4}$  n, 356.52 kgm.

From 12 to 36 months of age, the most outstanding Hereford female grade was the  $\frac{1}{2}$  H- $\frac{1}{2}$  N, with the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n its close second.

At the age of 36 months, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N weighed 312.98 kgm. or 15.47 kgm. heavier than the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n; 38.10 kgm. heavier than the  $\frac{1}{4}$  H- $\frac{1}{2}$  N- $\frac{1}{4}$  n; 56.25 kgm. heavier than the  $\frac{1}{4}$  H- $\frac{5}{8}$  N- $\frac{1}{8}$  n; 58.97 kgm. heavier than the  $\frac{1}{2}$  H- $\frac{1}{2}$  n; 60.48 kgm. heavier than the Hereford; and 102.05 kgm. heavier than the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n.

*The growth in height at withers*

*The pure breeds.* The relative heights of the Native, Nellore, and Hereford followed the same general trend; that is, the Native was much closer to the Nellore than to the Hereford. The Nellore was the tallest and the Native was taller than the Hereford, which is noted for its large size.

At 1 month of age, the Nellore male was 75.83 cm. tall; the Native, 69.25 cm.; and the Hereford, 58.00 cm. As the Native and the Hereford grew older, the difference in their heights became greater; the Hereford grew more slowly from 6 months of age, whereas the Native grew more rapidly. At 15 months of age, the Native male was 98.57 cm. tall; the Hereford, 80.00 cm.; and the Nellore, 109.00 cm. At the age of 48 months, the Nellore male was 133.25 cm. tall, whereas the Native was 120.00 cm.

Among the females the Nellore was the tallest; the Native, second; and the Hereford, the shortest. At the age of 1 month, the female Nellore was 73.47 cm. tall; the Native, 65.15 cm.; and the Hereford, 62.66 cm. At this age, the Native was taller than the Hereford by 2.49 cm.; at 15 months, by 3.95 cm.; and at 54 months, by 4.67 cm. The Nellore was always about eight to eighteen cm. taller than the Native and about ten to twenty cm. taller than the Hereford.

At 60 months of age, the Nellore female was 126.67 cm. tall, or 18.92 cm. taller than the Hereford and 17.17 cm. taller than the Native.

*The Native and Native grades.* In general, the infusion of the Hereford blood affected adversely the height of the crossbred animals. The Native grade with  $\frac{3}{4}$  Hereford blood was the shortest. The  $\frac{1}{4}$  n- $\frac{3}{4}$  N,  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N, and  $\frac{1}{8}$  n- $\frac{1}{4}$  H- $\frac{5}{8}$  N grades were taller than the Native. At the age of 48 months, the  $\frac{1}{4}$  n- $\frac{3}{4}$  N was 10.00 cm. taller than the Native; the  $\frac{1}{8}$  n- $\frac{1}{4}$  H- $\frac{5}{8}$  N, 70.00 cm. taller; and the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N, 4.80 cm. taller.

Except at the ages of 3 to 9 months, the  $\frac{1}{4}$  n- $\frac{3}{4}$  N was the tallest in the group, but after 9 months the  $\frac{1}{8}$  n- $\frac{1}{4}$  H- $\frac{5}{8}$  N became the tallest. At 48 months, the  $\frac{1}{4}$  n- $\frac{3}{4}$  N was 130.00 cm. tall; the  $\frac{1}{8}$  n- $\frac{1}{4}$  H- $\frac{5}{8}$  N, 127.00 cm.; the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N, 124.80 cm.; the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N, 124.25 cm.; the  $\frac{1}{2}$  n- $\frac{1}{2}$  N, 123.67 cm.; the Native, 120.00 cm.; the  $\frac{1}{2}$  n- $\frac{1}{2}$  H, 119.67 cm.; and the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N, 112.00 cm.

The Hereford also manifested its influence on its female grades in height at withers. The  $\frac{1}{8}$  n- $\frac{1}{4}$  H- $\frac{5}{8}$  N was the tallest from 6 to 15 months of age and the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N, the tallest from 15 to 36 months.

At the age of 54 months, the  $\frac{1}{4}$  n- $\frac{3}{4}$  N female was 118.50 cm. tall; the  $\frac{1}{2}$  n- $\frac{1}{2}$  N, 117.75 cm.; the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N, 115.30 cm.; the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N, 112.00 cm.; the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N, 111.25 cm.; Native, 110.00 cm.; and the  $\frac{1}{2}$  n- $\frac{1}{2}$  H, 107.00 cm.

*The Nellore and Nellore grades.* From 1 to 9 months of age, the Nellore was taller than any of its male grades. At 12 months of age, the Nellore was 106.20 cm. tall; the  $\frac{3}{4}$  N- $\frac{1}{4}$  n, 107.08 cm.; and the  $\frac{1}{2}$  N- $\frac{1}{2}$  H, 102.20 cm. From 33 months to maturity, the  $\frac{1}{2}$  N- $\frac{1}{2}$  H was the tallest in the group.

At the age of 60 months, the male  $\frac{1}{2}$  N- $\frac{1}{2}$  H was 137.00 cm. tall; the Nellore, 132.50 cm.; the  $\frac{3}{4}$  N- $\frac{1}{4}$  n, 131.00 cm.; the  $\frac{1}{2}$  N- $\frac{1}{4}$  H-

$\frac{1}{4}$  n, 127.75 cm.; the  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n, 127.20 cm.; the  $\frac{1}{2}$  N- $\frac{1}{2}$  n, 126.33 cm.; and the  $\frac{1}{8}$  N- $\frac{3}{4}$  H- $\frac{1}{8}$  n, 110.50 cm.

In the female Nellore group the Nellore was the tallest, while in the male group this breed was second in height. The  $\frac{1}{2}$  N- $\frac{1}{2}$  H, which was the shortest, became intermediate in height at withers after 5 months.

At the age of 60 months, the Nellore female was 126.67 cm. tall; the  $\frac{1}{2}$  N- $\frac{1}{2}$  H, 120.00 cm.; the  $\frac{1}{8}$  N- $\frac{3}{4}$  H- $\frac{1}{8}$  n, 118.00 cm.; the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, 117.75 cm.; the  $\frac{3}{4}$  N- $\frac{1}{4}$  n, 117.50 cm.; the  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n, 115.38 cm.; and the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n, 115 cm.

*The Hereford and Hereford grades.* The Hereford was the shortest of all the males in this group. Although the  $\frac{1}{4}$  H- $\frac{5}{8}$  N- $\frac{1}{8}$  n was the tallest up to 12 months of age, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N became the tallest at maturity. At 1 month of age, the  $\frac{1}{4}$  H- $\frac{5}{8}$  N- $\frac{1}{8}$  n was 74.33 cm. tall and the Hereford, 58.00 cm. At 15 months, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N was 106.40 cm. tall, whereas the Hereford was 80.00 cm. From 6 to 15 months of age, the Hereford increased only 4.50 cm. in height, whereas its male grades increased from 10 to 15 cm. From the age of 33 months to maturity, the three tallest animals were the  $\frac{1}{2}$  H- $\frac{1}{2}$  N, the  $\frac{1}{4}$  H- $\frac{5}{8}$  N- $\frac{1}{8}$  n, and the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n. At 60 months of age, the three tallest males were the  $\frac{1}{2}$  H- $\frac{1}{2}$  N, with 137.00 cm.; the  $\frac{1}{4}$  H- $\frac{1}{2}$  N- $\frac{1}{4}$  n, with 127.75 cm.; and the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, with 127.20 cm. At this age, no data were available for the male pure Hereford and the  $\frac{1}{4}$  H- $\frac{5}{8}$  N- $\frac{1}{8}$  n.

The height at withers of the female Hereford at birth was the lowest, but at 4 to 5 months of age it was slightly taller than the  $\frac{1}{2}$  H- $\frac{1}{2}$  N.

At the age of 36 months, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N was 127.70 cm. tall; the  $\frac{1}{4}$  H- $\frac{5}{8}$  N- $\frac{1}{8}$  n, 123.25 cm.; the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, 120.90 cm.; the  $\frac{1}{4}$  H- $\frac{1}{2}$  N- $\frac{1}{4}$  n, 117.50 cm.; the  $\frac{1}{2}$  H- $\frac{1}{2}$  N, 115.67 cm.; and the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n, 110.75 cm.

At the age of 54 months, the female  $\frac{1}{2}$  H- $\frac{1}{2}$  N was 116.00 cm. tall; the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, 115.00 cm.; the  $\frac{1}{4}$  H- $\frac{1}{2}$  N- $\frac{1}{4}$  n, 112.00 cm.; the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n, 111.25 cm.; the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, 107.00 cm.; and the Hereford, 105.33 cm.

#### *The growth in heart girth*

*The pure breeds.* The Nellore male had generally the largest heart girth and the Hereford, the smallest. From the age of 4 months on, the rate of growth in heart girth of the Hereford was slower than that of the Nellore and of the Native. At 15 months of age, the Hereford measured only 101.00 cm. at the heart girth, or 25.71 cm. smaller than that of the Native and 31.17 cm. smaller than that of the Nellore.

At 48 months of age, the heart girth of the Nellore male was 172.38 cm. and that of the Native, 170.50 cm. No data for the Hereford males were available at this age.

At 60 months of age, the heart girth of the Nellore female was 170.83 cm.; the Native, 153.67 cm.; and the Hereford, 153.00 cm.

*The Native and Native grades.* The  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N male had the largest heart girth at 1 to 5 months of age. From 6 months to maturity,

however, the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N had the largest heart girth in the male group. Compared with the rest of the grades, the heart girth of the Native was above the average for the group.

At the age of 48 months, the heart girth of the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N male was 179.80 cm.; the  $\frac{1}{2}$  n- $\frac{1}{2}$  H, 170.33 cm.; the Native, 170.00 cm.; the  $\frac{1}{8}$  n- $\frac{1}{4}$  H- $\frac{5}{8}$  N, 169.50 cm.; the  $\frac{1}{4}$  n- $\frac{3}{4}$  N, 166.83 cm.; the  $\frac{1}{2}$  n- $\frac{1}{2}$  N, 165.67 cm.; the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N, 164.00 cm.; and the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N, 160.67 cm.

The heart girth of the Native female at different ages was intermediate. From birth to 6 months of age, the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N female had the largest heart girth; from 18 months to maturity, the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N; and at 36 months, the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N.

At 60 months of age, the females of the Native and Native grades, in the descending order of their heart girths, were as follows: the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N, 164.00 cm.; the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N, 158.00 cm.; the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N, 157.00 cm.; the  $\frac{1}{2}$  n- $\frac{1}{2}$  N, 156.00 cm.; the Native, 153.67 cm.; the  $\frac{1}{2}$  n- $\frac{1}{2}$  H, 151.00 cm.; and the  $\frac{1}{4}$  n- $\frac{3}{4}$  N, 150.50 cm.

*The Nellore and Nellore grades.* The males of the  $\frac{1}{2}$  N- $\frac{1}{2}$  H and of the  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n had the largest heart girth in the group at 4 to 9 months and the  $\frac{1}{2}$  N- $\frac{1}{2}$  H, at 24 to 72 months of age. As a whole, the Nellore male was intermediate among its grades in heart girth.

At the age of 60 months, the heart girths in the descending order were: 193.67 cm. for the  $\frac{1}{2}$  N- $\frac{1}{2}$  H male; 180.67 cm. for the  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n; 176.33 cm. for the Nellore; 171.00 cm. for the  $\frac{1}{2}$  N- $\frac{1}{2}$  n; 165.00 cm. for the  $\frac{1}{8}$  N- $\frac{3}{4}$  H- $\frac{1}{8}$  n; 161.00 cm. for the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n; and 160.00 cm. for the  $\frac{3}{4}$  N- $\frac{1}{4}$  n.

Compared with the grades, the Nellore female was intermediate in heart girth at 1 to 30 months of age. From 36 months to maturity, however, the Nellore female was larger than all the grades. From the age of 1 month to 9 months, the  $\frac{1}{8}$  N- $\frac{3}{4}$  H- $\frac{1}{8}$  n had the largest heart girth; but from 9 to 30 months, the  $\frac{1}{2}$  N- $\frac{1}{2}$  H was the best. This confirms earlier data that the first generation crosses are the largest in heart girth. It also showed that at 33 to 60 months of age, the female Nellore was unsurpassed in heart girth by any of its grades. At 60 months of age, the heart girths of the female Nellore and its grades were: Nellore, 170.83 cm.; the  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n, 164.00 cm.; the  $\frac{1}{2}$  N- $\frac{1}{2}$  H, 159.00 cm.; the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n, 158 cm.; the  $\frac{1}{8}$  N- $\frac{3}{4}$  H- $\frac{1}{8}$  n, 157.00 cm.; the  $\frac{1}{2}$  N- $\frac{1}{2}$  n, 156.00 cm.; and the  $\frac{3}{4}$  N- $\frac{1}{4}$  n, 150.00 cm.

*The Hereford and Hereford grades.* In the Hereford and Hereford grades the largest heart girths in the males were shown by the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n at 1 to 4 months of age, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N at 5 to 9 months, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n at 12 to 24 months, and then again the  $\frac{1}{2}$  H- $\frac{1}{2}$  N from 27 months to maturity.

At 15 months of age, the heart girth of the male Hereford was 101.00 cm. This was 36.60 cm. smaller than the  $\frac{1}{2}$  H- $\frac{1}{2}$  N, 27.90 cm. smaller than the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, 27.25 cm. smaller than the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n, 21.67 cm. smaller than the  $\frac{1}{4}$  H- $\frac{1}{2}$  N- $\frac{1}{4}$  n, and 17.50 cm. smaller than the  $\frac{1}{4}$  H- $\frac{5}{8}$  N- $\frac{1}{8}$  n.

At the age of 60 months, the heart girth of the  $\frac{1}{2}$  H- $\frac{1}{2}$  N male was 193.67 cm.; of the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, 180.67 cm.; of the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, 170.00 cm.; of the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n, 165.00 cm.; and of the  $\frac{1}{4}$  H- $\frac{1}{2}$  N- $\frac{1}{4}$  n, 161.00 cm.

Among the females of the Hereford and its grades the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n had the largest heart girth at birth and from 1 to 18 months of age; the  $\frac{1}{2}$  H- $\frac{1}{2}$  N, at 12 to 48 months; and the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, at 54 months to 60 months.

At the age of 60 months, the heart girths of the females were as follows: the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, 164.00 cm.; the  $\frac{1}{2}$  H- $\frac{1}{2}$  N, 159.00 cm.; the  $\frac{1}{4}$  H- $\frac{1}{2}$  N- $\frac{1}{4}$  n, 158.00 cm.; the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n, 157.00 cm.; the Hereford, 153.00 cm.; and the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, 151.00 cm.

*The growth in length of the body from shoulder to ischium*

*The pure breeds.* The Nellore had the longest body from shoulder to ischium in the male group. At 15 months of age, the Nellore was 108.21 cm. long; the Native, 98.93 cm.; and the Hereford, 89.50 cm. At 48 months, the Native was 16.50 cm. shorter than the Nellore. None of the Hereford males measured reached this age.

At the age of 15 months, the Hereford's body was 9.43 cm. less than that of the Native, and 18.71 cm. less than that of the Nellore. That the Native could have a longer body than the Hereford was unexpected.

Among the females the Hereford had the longest body from 3 to 6 months of age. From the age of 8 months to maturity, however, the Nellore had the longest body in the female group. At the ages of 27 and 30 months, the female Hereford surpassed the Nellore. At the age of 48 months, the body of the Nellore was 131.46 cm. long; the Hereford, 125.50 cm.; and the Native, 123.70 cm. At the age of 60 months, the lengths of body of the pure breeds were: Nellore, 138.31 cm.; Native, 128.00 cm.; and Hereford, 127.00 cm.

*The Native and Native grades.* The increase in length of body from shoulder to ischium of the male Native and Native grades was so close to each other that it was difficult to determine their lengths at different ages. From 1 to 18 months of age, the Native was intermediate among its grades. From 18 to 48 months, its rate of growth was so slow that its body remained the shortest. From 1 to 42 months, the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N had the longest body and from 48 to 72 months, the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N.

At 48 months of age, the lengths of body of the male Native and Native grades were as follows: the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N, 145.00 cm.; the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N, 143.00 cm.; the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N, 140.50 cm.; the  $\frac{1}{2}$  n- $\frac{1}{2}$  H, 139.67 cm.; the  $\frac{1}{8}$  n- $\frac{1}{4}$  H- $\frac{5}{8}$  N, 139.00 cm.; the  $\frac{1}{4}$  n- $\frac{3}{4}$  N, 135.83 cm.; the  $\frac{1}{2}$  n- $\frac{1}{2}$  N, 131.00 cm.; and the Native, 123.50 cm.

Among the females, the  $\frac{1}{2}$  n- $\frac{1}{2}$  N had the longest body up to 2 months of age. From 3 to 60 months, however, the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N was the longest in this group. From 12 months to maturity, the Native was intermediate among its grades.

At 60 months of age, the lengths of the body of the female Native and Native grades were as follows: the  $\frac{1}{4}$  n- $\frac{1}{2}$  H- $\frac{1}{4}$  N, 133.00 cm.; the

Native, 128.00 cm.; the  $\frac{1}{8}$  n- $\frac{3}{4}$  H- $\frac{1}{8}$  N and the  $\frac{1}{4}$  n- $\frac{1}{4}$  H- $\frac{1}{2}$  N, both 127.00 cm.; the  $\frac{1}{2}$  n- $\frac{1}{2}$  H, 126.00 cm.; the  $\frac{1}{2}$  n- $\frac{1}{2}$  N, 125.00 cm.; and the  $\frac{1}{4}$  n- $\frac{3}{4}$  N, 118.50 cm.

*The Nellore and Nellore grades.* The Nellore male was intermediate in body length among its grades. At 2 months and at 12 months, however, its body was the longest in the group. At 1 month and 3 to 6 months of age, the  $\frac{1}{8}$  N- $\frac{3}{4}$  H- $\frac{1}{8}$  n had the longest body, but at 15 months to 54 months, the  $\frac{1}{2}$  N- $\frac{1}{2}$  H; at 60 months, the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n; and from 66 months to 72 months, the pure Nellore.

At 60 months of age, the lengths of the body of the male Nellore and Nellore grades were as follows: the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n, 151.50 cm.; the  $\frac{1}{2}$  N- $\frac{1}{2}$  H, 150.00 cm.; the Nellore, 148.25 cm.; the  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n, 147.20 cm.; the  $\frac{3}{4}$  N- $\frac{1}{4}$  n, 145.00 cm.; the  $\frac{1}{2}$  N- $\frac{1}{2}$  n, 140.67 cm.; and the  $\frac{1}{8}$  N- $\frac{3}{4}$  H- $\frac{1}{8}$  n, 140.00 cm.

As in the male, the female Nellore also was intermediate among its grades. At 1 to 20 months of age the  $\frac{1}{2}$  N- $\frac{1}{2}$  n had the longest body and from 3 to 15 months, the  $\frac{1}{8}$  N- $\frac{3}{4}$  H- $\frac{1}{8}$  n. From 15 months to 54 months, however, the  $\frac{1}{2}$  N- $\frac{1}{2}$  H had the longest body in the group; at 27 and 30 months of age, the  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n; and at 60 months, the pure Nellore.

In the female Nellore and Nellore grade group, the lengths of the body from 60 months of age were: Nellore, 138.31 cm.;  $\frac{1}{2}$  N- $\frac{1}{2}$  H, 135.00 cm.;  $\frac{1}{4}$  N- $\frac{1}{2}$  H- $\frac{1}{4}$  n, 133.00 cm.;  $\frac{1}{8}$  N- $\frac{3}{4}$  H- $\frac{1}{8}$  n, 127.00 cm.;  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n, 127.00 cm.;  $\frac{1}{2}$  N- $\frac{1}{2}$  n, 125.00 cm.; and  $\frac{3}{4}$  N- $\frac{1}{4}$  n, 118.50 cm.

*The Hereford and Hereford grades.* From 9 to 54 months of age, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N in the male group had the longest body. From 4 to 15 months of age, the Hereford had the shortest body. After reaching the age of 60 months the males of the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, and the  $\frac{1}{4}$  H- $\frac{1}{2}$  N- $\frac{1}{4}$  n were practically the same. The male Hereford grade with the longest body was the  $\frac{1}{4}$  H- $\frac{1}{2}$  N- $\frac{1}{4}$  n, measuring 152.25 cm. at 72 months of age. At the age of 60 months, the lengths of body of the male grades were as follows: the  $\frac{1}{4}$  H- $\frac{1}{2}$  N- $\frac{1}{4}$  n, 151.50 cm.; the  $\frac{1}{2}$  H- $\frac{1}{2}$  N, 150 cm.; the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, 149.00 cm.; the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, 147.20 cm.; and the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n, 140.00 cm. There were no available data for the male Hereford at that age.

Among the female Hereford and Hereford grades, the  $\frac{1}{2}$  H- $\frac{1}{2}$  n had the longest body at 1 and 12 months of age. From 3 to 15 months of age, the longest animal was the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n. From 15 to 24 months of age, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N was the longest. At 27 and 30 months of age, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was the longest. From 33 to 60 months of age, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N was the longest in the female group. At 60 months of age, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N female measured 135.00 cm.; the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, 133.00 cm.; the Hereford, the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n and the  $\frac{1}{4}$  H- $\frac{1}{2}$  N- $\frac{1}{4}$  n, 127.00 cm. each. The  $\frac{1}{2}$  H- $\frac{1}{2}$  n had the shortest body, 126.00 cm.

*The  $\frac{1}{2}$  Nellore —  $\frac{1}{2}$  Native,  $\frac{1}{2}$  Hereford —  $\frac{1}{2}$  Native,  $\frac{1}{2}$  Hereford —  $\frac{1}{2}$  Nellore,  $\frac{1}{2}$  Hereford —  $\frac{1}{4}$  Nellore —  $\frac{1}{4}$  Native, and  $\frac{1}{2}$  Nellore —  $\frac{1}{4}$  Hereford,  $\frac{1}{4}$  Native*

In comparing the relative merits of animals possessing 50 per cent of the blood of the basic breeds, it was noted that in the male group the weights

from birth to 4 months of age of the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n and the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n interchanged ranks. From 9 to 36 months of age, the heaviest animal was the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n; and from 42 to 72 months, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N. The animals with the lowest weights from birth to 15 months of age were the  $\frac{1}{2}$  N- $\frac{1}{2}$  n and the  $\frac{1}{2}$  H- $\frac{1}{2}$  n; from 18 to 42 months, the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, and the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n. From 48 to 72 months of age, the lightest were again the  $\frac{1}{2}$  N- $\frac{1}{2}$  n and the  $\frac{1}{2}$  H- $\frac{1}{2}$  n; and at 60 months, the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n.

In height at withers in the male group, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N was the best from 16 to 72 months of age. From 42 to 60 months, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N was better than the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n in weight, height at withers, heart girth, and length of body from shoulder to ischium. The  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was second to the  $\frac{1}{2}$  H- $\frac{1}{2}$  N. The inferior animals were: in weight, the  $\frac{1}{2}$  N- $\frac{1}{2}$  n, the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n, and the  $\frac{1}{2}$  H- $\frac{1}{2}$  n; in height at withers, the  $\frac{1}{2}$  H- $\frac{1}{2}$  n; in heart girth, the  $\frac{1}{2}$  N- $\frac{1}{2}$  n and the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n; and in length of body, the  $\frac{1}{2}$  H- $\frac{1}{2}$  n and the  $\frac{1}{2}$  N- $\frac{1}{2}$  n.

The relative merits of the Hereford and the Nellore blood for improving the Native stock were noted in the  $\frac{1}{2}$  N- $\frac{1}{2}$  n and the  $\frac{1}{2}$  H- $\frac{1}{2}$  n which made improvements over the Native in practically all respects, except in heart girth. The  $\frac{1}{2}$  H- $\frac{1}{2}$  n was slightly better than the  $\frac{1}{2}$  N- $\frac{1}{2}$  n in weight, in heart girth, and in length of body, whereas the  $\frac{1}{2}$  N- $\frac{1}{2}$  n was better than the  $\frac{1}{2}$  H- $\frac{1}{2}$  n in height at withers.

At 12 months of age, the male  $\frac{1}{2}$  H- $\frac{1}{2}$  n and the  $\frac{1}{2}$  N- $\frac{1}{2}$  n showed little improvement over the Native. At the age of 24 months, the  $\frac{1}{2}$  H- $\frac{1}{2}$  n was superior to the Native by 33.78 per cent in weight, 1.82 per cent in height at withers, 6.45 per cent in heart girth, and 7.23 per cent in body length; whereas the  $\frac{1}{2}$  N- $\frac{1}{2}$  n was better than the Native by only 6.64 per cent in weight, 0.94 per cent in height at withers, and 4.61 per cent in length of body. The  $\frac{1}{2}$  H- $\frac{1}{2}$  n made 6.45 per cent improvement in heart girth over the Native at 24 months, while the  $\frac{1}{2}$  N- $\frac{1}{2}$  n was poorer than the Native by 3.16 per cent. At the age of 36 months, the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, improved 12.71 per cent in weight and 2.39 per cent in length of body over the Native than the  $\frac{1}{2}$  N- $\frac{1}{2}$  n. In height at withers, the  $\frac{1}{2}$  N- $\frac{1}{2}$  n was better than the Native by 2.84 per cent, whereas the  $\frac{1}{2}$  H- $\frac{1}{2}$  n was poorer than the Native by 1.56 per cent. In heart girth, both showed no improvement over the Native. At 48 months, the  $\frac{1}{2}$  H- $\frac{1}{2}$  n made an improvement in weight and body length of 7.93 per cent and 7.02 per cent, respectively, over the  $\frac{1}{2}$  N- $\frac{1}{2}$  n.

In height at withers, the  $\frac{1}{2}$  N- $\frac{1}{2}$  n was better than the Native by 3.06 per cent, whereas the  $\frac{1}{2}$  H- $\frac{1}{2}$  n was poorer by 0.28 per cent.

Among the females, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was the heaviest of all the "halves" from 2 to 6 months of age. From 9 to 36 months, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N was the heaviest in the female group and the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was second from 12 to 36 months of age. At 42 months and 60 months, they exchanged places. In heart girth and in length of body, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N and the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n were the best at maturity; the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was superior to the  $\frac{1}{2}$  H- $\frac{1}{2}$  N in heart girth, but it was inferior in body length, though they were very close to each other. In height at withers, the  $\frac{1}{2}$  N- $\frac{1}{2}$  n and the  $\frac{1}{2}$  H- $\frac{1}{2}$  N were almost the same and the best in the female group at maturity.

The poorest in weight from 30 to 60 months of age were the  $\frac{1}{2}$  H- $\frac{1}{2}$  n and the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n. On the whole, the poorest in height at withers was the  $\frac{1}{2}$  H- $\frac{1}{2}$  n; in heart girth, the  $\frac{1}{2}$  H- $\frac{1}{2}$  n; and in body length, the  $\frac{1}{2}$  N- $\frac{1}{2}$  n, especially at maturity. Generally, the female  $\frac{1}{2}$  N- $\frac{1}{2}$  n was slightly better than the  $\frac{1}{2}$  H- $\frac{1}{2}$  n in weight, height at withers, and heart girth. In length of body, the  $\frac{1}{2}$  H- $\frac{1}{2}$  n was a little better than the  $\frac{1}{2}$  N- $\frac{1}{2}$  n.

At 12 months of age, the female  $\frac{1}{2}$  N- $\frac{1}{2}$  n had 4.70 per cent improvement in weight, 4.01 per cent in height at withers, and 0.29 per cent in length of body over the female Native. At this age, the  $\frac{1}{2}$  H- $\frac{1}{2}$  n did not show any improvement over the Native, except in length of body, when it was 3.25 per cent better. In heart girth, both the  $\frac{1}{2}$  N- $\frac{1}{2}$  n and the  $\frac{1}{2}$  H- $\frac{1}{2}$  n made no improvement over the Native at 12 months of age.

At the age of 24 months, the female  $\frac{1}{2}$  N- $\frac{1}{2}$  n improved over the female Native 24.36 per cent in weight, 5.42 per cent in height at withers, 6.08 per cent in heart girth, and 0.68 per cent in length of body. The  $\frac{1}{2}$  H- $\frac{1}{2}$  n improved 27.04 per cent over the Native in weight and 4.33 per cent in length of body, but showed no improvement in height at withers and heart girth.

At 36 months, the female  $\frac{1}{2}$  N- $\frac{1}{2}$  n had 20.06 per cent improvement in weight over the female Native, whereas the  $\frac{1}{2}$  H- $\frac{1}{2}$  n had only 6.89 per cent. In height at withers, the  $\frac{1}{2}$  N- $\frac{1}{2}$  n had 6.81 per cent improvement, whereas the  $\frac{1}{2}$  H- $\frac{1}{2}$  n showed no improvement over the Native. In heart girth, the  $\frac{1}{2}$  N- $\frac{1}{2}$  n was better than the Native by 5.68 per cent and the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, by only 1.23 per cent. In length of body, the  $\frac{1}{2}$  N- $\frac{1}{2}$  n made a 6.90 per cent improvement over the Native and the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, 6.03 per cent.

At 48 months, the female  $\frac{1}{2}$  N- $\frac{1}{2}$  n was better than the female Native in weight by 6.30 per cent, in height at withers by 6.80 per cent, in heart girth by 4.06 per cent, and in length of body by 0.85 per cent. On the other hand, the  $\frac{1}{2}$  H- $\frac{1}{2}$  n showed no improvement over the Native except in length of body, where it was 3.07 per cent better than the female Native.

If the increase in weight, height at withers, heart girth, and length of body from shoulder to ischium are summarized, the first generation cross-bred males may be listed in the order of their superiority as follows: The  $\frac{1}{2}$  H- $\frac{1}{2}$  N, first; the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, second; the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, third; the  $\frac{1}{2}$  N- $\frac{1}{2}$  n, fourth; and the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n, last. Among the females, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N was first; the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, second; the  $\frac{1}{2}$  N- $\frac{1}{2}$  n, third; the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, fourth; and the  $\frac{1}{2}$  N- $\frac{1}{4}$  H- $\frac{1}{4}$  n, last. Thus, with the exception of the  $\frac{1}{2}$  N- $\frac{1}{2}$  n which exchanged position with the  $\frac{1}{2}$  H- $\frac{1}{2}$  n, the results with the females are the same as those with the males.

*The 3/4 Nellore — 1/4 Native and 3/4 Hereford 1/8 Nelore — 1/8 Native*

The animals possessing an average of about 75 per cent of the blood of any of the two basic breeds, or "three-quarter" grades, showed that from birth to 12 months of age, the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n male was heavier than the  $\frac{3}{4}$  N- $\frac{1}{4}$  n. From 15 months to maturity, the reverse was true.

At the age of 60 months, the male  $\frac{3}{4}$  N- $\frac{1}{4}$  n weighed 393.72 kgm. and the male  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n, 316.61 kgm. In height at withers, the  $\frac{3}{4}$  N- $\frac{1}{4}$  n was superior to the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n. In heart girth, the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n was superior to the  $\frac{3}{4}$  N- $\frac{1}{4}$  n from birth to 18 months. From 18 months to maturity, the  $\frac{3}{4}$  N- $\frac{1}{4}$  n had a larger heart girth than the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n. In length of body, the male  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n was again superior to the male  $\frac{3}{4}$  N- $\frac{1}{4}$  n from birth to 18 months. But again from 18 months to maturity, the  $\frac{3}{4}$  N- $\frac{1}{4}$  n measured longer than the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n, though from the age of 48 to 54 months, the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n was longer than the  $\frac{3}{4}$  N- $\frac{1}{4}$  n by about 4.5 cm.

From birth to 6 months of age, the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n female was heavier than the  $\frac{3}{4}$  N- $\frac{1}{4}$  n, except at the ages of 30, 42, and 60 months. At these ages, there was only a slight difference in the weights. In height at withers, the  $\frac{3}{4}$  N- $\frac{1}{4}$  n was better than the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n. The  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n had a larger heart girth than the  $\frac{3}{4}$  N- $\frac{1}{4}$  n throughout except at 54 months, when the  $\frac{3}{4}$  N- $\frac{1}{4}$  n exceeded the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n by about two cm. The  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n had a longer body than the  $\frac{3}{4}$  H- $\frac{1}{4}$  n.

*The 1/2 Nellore — 1/2 Native and 3/4 Nellore — 1/4 Native*

Both crossbreeds showed in the male group decided improvement over the Native in weight, height at withers, and length of body. In heart girth, the improvement was not definite. At 24 months of age, the male  $\frac{3}{4}$  N- $\frac{1}{4}$  n was better by 9.96 per cent in weight, 8.28 per cent in height at withers, and 4.85 per cent in length of body over the Native than the male  $\frac{1}{2}$  N- $\frac{1}{2}$  n. In heart girth, both were inferior to the Native. At 36 months of age, the male  $\frac{3}{4}$  N- $\frac{1}{4}$  n improved 4.39 per cent in weight, 4.40 per cent in height at withers, and 1.13 per cent in body length over the Native than the  $\frac{1}{2}$  N- $\frac{1}{2}$  n. In heart girth, both were again inferior to the Native. At 48 months, the male  $\frac{3}{4}$  N- $\frac{1}{4}$  n improved 8.69 per cent in weight, 5.28 per cent in height at withers, and 3.91 per cent in length of body over the Native than the  $\frac{1}{2}$  N- $\frac{1}{2}$  n.

The female  $\frac{1}{2}$  N- $\frac{1}{2}$  n was a decided improvement over the Native; it was superior to the  $\frac{3}{4}$  N- $\frac{1}{4}$  n in weight, heart girth, and length of body from shoulder to ischium. In height at withers, however, the  $\frac{3}{4}$  N- $\frac{1}{4}$  n was superior to the Native and the  $\frac{1}{2}$  N- $\frac{1}{2}$  n.

*The 1/2 Hereford—1/4 Nellore—1/4 Native and 3/4 Hereford—1/8 Nellore — 1/8 Native*

In all measurements of the males, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was decidedly superior to the Native and to the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n, although from birth to 9 months of age, the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n was the heaviest. From 12 months to maturity, however, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was the heaviest.

In weight at 12 months of age, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n made 11.22 per cent, 5.80 per cent in heart girth, more improvement over the Native than the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n. In height at withers, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n showed 5.16 per cent improvement over the Native, whereas the  $\frac{3}{4}$  H-

$\frac{1}{8}$  N- $\frac{1}{8}$  n was 0.16 per cent shorter than the Native. In length of body, the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n made 0.40 per cent more improvement over the Native than the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n.

In weight at 24 months of age, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n made 1.11 per cent and in length of body, 4.03 per cent more improvement than the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n. In height at withers, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was better than the Native by 5.02 per cent, whereas the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n was shorter than the Native by 2.89 per cent. Similarly, in heart girth, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was better than the Native by 8.64 per cent, whereas the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n was 3.59 per cent smaller in heart girth than the Native.

At 36 months, the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n was better by 6.55 per cent than the Native only in length of body. At 36 months, however, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was superior in all measurements to the Native; it was 34.78 per cent heavier, 2.89 per cent taller, 6.06 per cent larger in heart girth, and 12.74 per cent longer in body than the Native.

In weight at the age of 48 months, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n made 42.30 per cent and in length of body, 2.02 per cent more improvement over the Native than the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n. In height at withers and in heart girth, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was better by 4.00 per cent and 5.46 per cent, respectively, than the Native, whereas the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n made no improvement over the Native.

Among the females, the Native was much inferior to the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, except in weight and heart girth. The Native was also inferior to the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n. The superiority of the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n and the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n was as pronounced in the females as in the males.

From this observation, it may be stated that in both the males and females the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was by far superior to the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n and the Native.

#### *The Philamin*

The most outstanding animals produced in the College of Agriculture were those the blood composition of which were  $\frac{1}{2}$  H- $\frac{1}{2}$  N and  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n. Efforts were accordingly directed to the formation of a new breed of cattle, using as foundation stock the best bull from the  $\frac{1}{2}$  H- $\frac{1}{2}$  N cross and the best 5 cows from the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n.

Among the males, the F<sub>1</sub> Philamin proved to be superior to the two basic breeds, the Native and the Hereford, in weight, height at withers, and length of body, but inferior to the Nellore and to the foundation stock. In heart girth, however, the F<sub>1</sub> Philamin was inferior to the Native, the Nellore, and the foundation stock from the age of 15 to 48 months.

At the age of 48 months, the F<sub>1</sub> Philamin male made an improvement of 23.77 per cent over the Native in weight, 1.67 per cent in height at withers, and 12.55 per cent in length of body. Its heart girth was smaller than that of the Native by 7.33 per cent, although not much significance can be attached to it, as there was but one animal representing the F<sub>1</sub> Philamin at this age.

As in the male, the F<sub>1</sub> Philamin female was inferior to the Nellore and the foundation stock. In some instances, it was even inferior to the Here-

ford in weight from birth to 5 months of age, and from 12 to 30 months. Thus, the superiority of F<sub>1</sub> Philamin to the Hereford and to the Native was not so marked in the female as in the male.

The superiority of the selected foundation stock over the unselected F<sub>1</sub> and F<sub>2</sub> Philamin showed the importance and the urgency of rigidly selecting and culling out the undesirable animals in the development of a new breed.

The best Philamin bull produced in the College was Marcos, H.N. 203. Provincial Fair, H.N. 93, the foundation stock bull, was superior to Marcos, H.N. 203 in all measurements, except in weight. From 15 to 48 months of age, Provincial Fair, H.N. 93, was heavier than Marcos, H.N. 203; but at the age of 4 to 12 months, and after 54 months to maturity, Marcos, H.N. 203, was better than Provincial Fair, H.N. 93.

At the age of 60 months, Marcos, H.N. 203, was heavier than Provincial Fair, H.N. 93, by 40.82 kgm.; at 66 months, by 21.77 kgm.; and at 72 months, by 22.68 kgm.

During the early stage of the formation of the Philamin breed the average of the 5 foundation cows was still better in all measurements than the best cow of the F<sub>1</sub> Philamin, Bonifacia, H.N. 110.

#### SUMMARY

1. Of the three breeds of cattle studied, the Native, Nellore, and the Hereford, the Nellore males and females were the heaviest and tallest and had the largest heart girth and longest body. The Native males and females were second in height at withers and heart girth; the Hereford males and females, last. Although the male Hereford was the lightest in weight, its female was heavier than the female Native. The male Hereford had the shortest body, but its female had a longer body than the female Native.

2. The Native stock can be improved by the infusion of either Nellore or Hereford blood or their combination. In the improvement of the Native stock in weight or size alone, either a Hereford or a Nellore bull can be used. The Nellore bull is preferable to the Hereford because it is easier to secure locally and is more at home in the Philippines. If squattiness, blocky form, good disposition, and early maturity are desired in the grades, the Hereford should be preferred.

In increasing the amount of Nellore blood in the Nellore-Native grades from 50 to 75 per cent in the male, the  $\frac{3}{4}$  N- $\frac{1}{4}$  n manifested an improvement over the  $\frac{1}{2}$  N- $\frac{1}{2}$  n. In the female, the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was better than either the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n or the  $\frac{1}{2}$  H- $\frac{1}{2}$  n. The cross-breeds with less than 50 per cent of the Hereford blood were inferior to those with 50 per cent. On the other hand, when the Hereford blood was increased to 75 per cent, the resulting crosses were as poor as those with less than 50 per cent. The data bear out the observations that whenever the amount of Hereford blood in the Hereford crosses was increased to 75 per cent or more, the animals behaved in a manner similar to the pure Hereford in constitutional weakness.

3. The Hereford blood contributed to its crosses early rapid growth, long body, and low-set conformation. On the other hand, the Nellore blood

imparted to its grades a small heart girth, late maturity, and great height at withers, which makes the animal upstanding.

4. All Native crosses, irrespective of sex, showed improvement over the Native. Of all the Native crosses, the most outstanding in both sexes was the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n, which was much better than either the Hereford or the Nellore. The only animal that surpassed the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n was the  $\frac{1}{2}$  H- $\frac{1}{2}$  N cross.

The males in all the Hereford crosses were better than the pure Hereford, but the pure Hereford female was intermediate among its grades. Not all Nellore crosses were better than the Nellore; in fact, the only Nellore crosses that were decidedly better were the  $\frac{1}{2}$  H- $\frac{1}{2}$  N and the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n.

5. The best of the "three quarters" in the male was the  $\frac{3}{4}$  N- $\frac{1}{4}$  n. In the female, however, the  $\frac{3}{4}$  H- $\frac{1}{8}$  N- $\frac{1}{8}$  n was better than the  $\frac{3}{4}$  N- $\frac{1}{4}$  n.

6. Although, in some cases, the females were more outstanding in growth than the males of the same blood composition, in the majority of cases or on the average, the males were heavier than the females.

7. The average weight at birth of males in the different groups was 22.35 kgm. and the females, 21.07 kgm.

8. A study of the 60 experimental animals that reached the age of at least 60 months tends to show that no constant relation exists between the weight at birth and the weight at maturity.

9. Of the first generation crosses, the  $\frac{1}{2}$  H- $\frac{1}{2}$  N and the  $\frac{1}{2}$  H- $\frac{1}{4}$  N- $\frac{1}{4}$  n exhibited the most outstanding growth. The  $\frac{1}{2}$  H- $\frac{1}{2}$  N cross was the largest animal found in this study. It was superior to either of its parents not only in weight but also in height, heart girth, and length of body.

#### LITERATURE CITED

- BURCH, S. D., E. W. SHEETS, H. J. WATERS, AND E. A. TROWBRIDGE. 1926. Grading up beef cattle at Sni-A-Bar farms. United States Department of Agriculture Circular 74: 1-27. *Fig. 1-20.*
- ECKLES, C. H. AND W. W. SWETT. 1918. Some factors influencing the rate of growth and the size of dairy heifers at maturity. Missouri Agric. Exper. Sta. Res. Bul. 31: 1-56. *Fig. 1-16.*
- ECKLES, C. H. 1919. A study of the birth weight of calves. Missouri Agric. Exper. Sta. Res. Bull. 35: 1-11. *Fig. 1.*
- ECKLES, C. H. 1920. The normal growth of dairy cattle. Missouri Agric. Exper. Sta. Res. Bull. 35: 1-20. *Fig. 1-5.*
- ESPE, D. L., C. Y. CANNON, AND E. N. HANSEN. 1932. Normal growth in dairy cattle. Iowa Agric. Exper. Sta. Res. Bull. 154: 299-319. *Fig. 1-4.*
- GONZALEZ, B. M. 1924. Selecting farm animals. The Journal of Heredity 15: 261-262. *Fig. 1-14.*
- HOGAN, A. G., AND H. D. FOX. 1923. Growth curves for beef steers. Missouri Agricultural Experiment Station Research Bulletin 62: 6-10. *Fig. 1-2.*
- LUSH, J. L. 1928. Practice and problems involved in cross breeding cattle in the coastal plain of Texas. The American Society of Animal Production: Proceedings 1928. 58-61.

- LUSH, J. L., J. M. JONES, W. H. DAMERON, AND O. L. CARPENTER. 1930. Normal growth of range cattle. Texas Agric. Exper. Sta. Bull. 409: 1-34. *Fig. 1-14.*
- MOULTON, C. R., P. E. TROWBRIDGE, AND L. D. HAIGH. 1921. Studies in animal nutrition. (1. Changes in form and weight at different planes of nutrition). Missouri Agric. Exper. Sta. Res. Bull. 43: 1-111. *Fig. 1-30.*
- MOULTON, C. R. 1923. Growth of Hereford Shorthorn steer. Missouri Agric. Exper. Sta. Res. Bull. 62: *Fig. 3-10.*
- TROWBRIDGE, P. F., C. R. MOULTON, AND L. D. HAIGH. 1918. Effect of limited feed supply on the growth of young beef animals. Missouri Agric. Exper. Sta. Res. Bull. 28: 1-129. *Fig. 1-23.*

# BEHAVIOR OF FIVE BRAZILIAN RICE VARIETIES UNDER LOWLAND CULTURE IN THE COLLEGE OF AGRICULTURE<sup>1</sup>

JOSÉ M. CAPINPIN AND TEODOMERO M. YÑIGUEZ  
*Of the Department of Agricultural Botany*

Most of the rice improvements made in other countries have been accomplished by introduction and selection. Some leading standard rice varieties from Brazil have recently been introduced in the College of Agriculture. Preliminary plot tests on the suitability of these varieties to local conditions gave encouraging results. The present investigation was conducted for the purpose of recording the principal characteristics of the varieties and evaluating them according to their behavior and response to local methods of rice culture.

The work was conducted from June, 1947, to January, 1948, in the experimental lots and laboratory of the Department of Agricultural Botany, College of Agriculture, Los Baños, Laguna.

## MATERIALS AND METHODS

*Varieties used.* The rice varieties used in this study were the Dourado agulha, Iguape agulha, Perola, Cateto, and Jaguari. The seeds came from Sao Paulo, Brazil. According to Viegas<sup>2</sup>, Germek and Miranda, these varieties are widely grown in Sao Paulo, Brazil, because of their wide range of adaptability, and the nonshattering character, good milling and keeping quality of the grain.

*Seedbed.* Seedbeds, each 50 centimeters square, were prepared in the ordinary wet-bed method. On July 5, 1947, water was allowed into the plots to rot the weeds. Nine days later, the plots were first dug with a mattock and a spading fork, puddled, and then leveled with the feet and a garden rake. A cut was made at the end of each dike to allow water to enter the paddies when needed or to let water out when not needed. A drainage ditch around the seedbeds was made sufficiently deep and kept filled with water to keep the rats out.

*Sowing the seeds.* On July 11, 1947, the seeds of each variety were placed in a labeled cloth bag and soaked in water for 24 hours, and then placed in the shade for 48 hours to hasten germination. Three days later, the sprouting seeds of the five varieties of rice were separately sown in the prepared seedbed. Variety Dourado agulha was sown in seedbed A, Iguape agulha in seedbed B, Perola in seedbed C, Cateto in seedbed D, and Jaguari in seedbed E.

*Culture plots.* The experimental lot was located at the back of the Agricultural Botany Department. After the land was cleared of weeds,

<sup>1</sup>Experiment Station Contribution No. 1542. Based on the thesis presented for graduation by the junior author with the degree of Bachelor of Science in Agriculture from the College of Agriculture, March, 1948.

<sup>2</sup>VIEGAS, G. P., E. B. GERMEK AND H. S. MIRANDA. 1945. Contribucao para a melhoria da Rizicultura no Estado de S. Paulo. *Bragantia* 5: 187-196.

the lot was divided into five paddies. Each paddy measured 12 meters long and 1.25 meters wide. Dikes, 35 centimeters high, were constructed to separate the paddies, which were labeled A, B, C, D, and E.

On July 28, 1947, the paddies were dug with a spading fork and then with a mattock to turn under all the weeds. Water was run into the paddies to submerge the grasses and other weeds and to hasten their decomposition. On August 12, 1947, the paddies were drained, puddled, and leveled. Water was again turned in for the second time to further hasten the decomposition of the weeds. When the weeds were well rotted, the paddies were again drained, puddled, and leveled.

*Transplanting.* On August 22, 1947, one day prior to the pulling up of the seedlings, water was turned into the seedbeds to soften the soil and to facilitate the uprooting of the seedlings. The seedlings were tied into bundles of convenient size and labeled. The leaves were first pruned. Afterwards, the seedlings were transplanted to the paddies, one seedling to a hill. The distance between hills was 25 centimeters.

*Care of plants.* Three or four days later when the young plants were sufficiently established, water from a faucet was turned into the paddies to submerge the soil to a depth of 12 centimeters. This submergence of the paddies was continued until the plants had reached the booting stage, when surplus water was finally drained and the soil in the paddies was merely kept moist.

#### RESULTS AND DISCUSSION

##### *Field observations*

The seedlings and their leaves appeared to be uniform in height and color. No insect pest was noted during the seedling stage. The seedlings were transplanted 40 days after sowing the seeds in the seedbeds. Soon after transplanting, the seedlings grew vigorously and quite uniformly. There were no marked differences in the external appearance of the plants of each variety. Tillering was observed two weeks after transplanting.

The most serious pest noted when the plants had grains was the red rice weavers, *Lonchura ferruginosa jagori* Martens, which came in groups and fed on the grains. They began to feed on the grains as early as the milk stage up to the maturity of the grain. The damage was minimized by scaring the birds away from the plants. The damage caused by the rice stem borer, *Schoenobius incertellus* Walker, was apparently slight, as this was noted only in a few plants in each culture. To check its spread, the infested plants were pulled out as soon as the pest had been discovered. A more common plant pest was the rice bug, *Leptocorisa acuta* Thunberg, which was noted in all the five varieties during the milk stage of the grains. This pest was found most numerous on varieties Dourado agulha and Iguape agulha. The rice weevil, *Sitophilus oryzae* Linn., which is a pest of stored grains, was noted in the cultures. However, the damage caused by it was slight. Hand picking of the pests was done as often as these were discovered in the culture to minimize destruction on the plants. No damage was caused by any fungous and bacterial disease.

It was observed that the rice varieties studied were of the non-lodging type; the plants remained standing in spite of successive strong winds that prevailed during the growth period. Moreover, the plants of all the five varieties were rather short.

There was no marked difference in external appearance among the individual plants of the same variety. In general, it was hard to distinguish one variety from another by the color of plant structures. The varieties studied may, however, be differentiated by the color<sup>3</sup> of the glume tips. The glume tip of variety Iguape agulha was light coral red, while that of Perola was liver brown. The other three varieties had glume tips of the same color, massicot yellow, during the milk stage of the grain. The hull of the grain of variety Dourado agulha was ochraceous buff, while hulls of the grains of the other varieties were alike, light ochraceous buff, when the grains were at the mature stage. Thus, it appears that except for these variations in color of the glume tips and hulls, no marked differences in color of plant structures were observed among the different rice varieties studied. The color of the leaf sheaths, leaves, nodes and internodes varied from schules green to cedar green, peacock green, and grass green, irrespective of varieties.

The rice varieties studied were of the nonshattering type; the grains were not easily detached from the panicles. None of the grains of the five varieties were awned.

*The biometrics of the physical characters studied*

The results of laboratory analyses are presented in tables 1 to 17. All data are averages of the characters of the 50 plants studied belonging to each of the five varieties. For convenience of reference in this study, the rice variety Dourado agulha is designated *A*; Iguape agulha, *B*; Perola, *C*; Cateto, *D*; and Jaguari, *E*. In all statistical comparisons, the value of Fisher's "t" at 49 degrees of freedom was used in establishing the level of significance at five per cent and one per cent.

*Plant height, length, and width of leaves.* The plant heights from the base to the tip of the longest leaf of 50 representative plants (table 1) of the five varieties, taken at random, ranged from 101 $\bar{+}$ 1.23 centimeters in Cateto to 123.3 $\bar{+}$ 1.37 centimeters in variety Iguape agulha. Perola had the second highest mean height of plants, 123.16 $\bar{+}$ 1.24 centimeters, whereas Dourado agulha and Jaguari had the third and fourth highest means, 118.9 $\bar{+}$ .87 and 113.2 $\bar{+}$ .99 centimeters, respectively. Results of statistical comparisons (table 14) show that all differences between varieties, except those between Iguape agulha and Perola, were all highly significant. The difference in mean heights of plants between Iguape agulha and Perola was not significant.

The length of leaves (table 2) varied from 37.82 $\bar{+}$ .83 centimeters in Iguape agulha to 31.76 $\bar{+}$ .51 centimeters in Cateto. Perola had a mean length of leaves of 36.32 $\bar{+}$ .77; Dourado agulha, 36.08 $\bar{+}$ .33; and Jaguari, 35.36 $\bar{+}$ .69 centimeters. Statistical comparisons show that

<sup>3</sup>Ridgway, R. 1912. Color standards and color nomenclature. iii + 42 p., 53 pl. Washington, D. C.: A. Hoen and Company.

the difference between the highest mean (Iguape agulha) and the lowest (Cateto) was highly significant. Other highly significant differences in leaf lengths were also found between Dourado agulha and Cateto; between Perola and Cateto; and between Cateto and Jaguari. The difference in leaf-length means between Dourado agulha and Iguape agulha, between Dourado agulha and Perola, between Dourado agulha and Jaguari, and between Perola and Jaguari were insignificant.

The means of the widths of leaves (table 3) ranged from  $1.49 \pm .03$  centimeters in Jaguari to  $1.85 \pm .03$  centimeters in Iguape agulha. The mean width of the leaves of Perola was  $1.69 \pm .03$  centimeters, of Dourado agulha,  $1.64 \pm .03$  centimeters, and of Cateto,  $1.56 \pm .02$  centimeters. Statistical comparisons (table 14) show that the differences between the Dourado agulha and Perola, and between Dourado agulha and Cateto were insignificant. However, the differences between the means of Dourado agulha and Iguape agulha, between Dourado agulha and Jaguari, between Iguape agulha and Perola, between Iguape agulha and Cateto, between Iguape agulha and Jaguari, between Perola and Cateto, between Perola and Jaguari, and between Cateto and Jaguari were highly significant.

It is interesting to note that of the characters compared, the differences of the means between any two varieties in plant height were highly significant, except the difference between the means of Iguape agulha and Perola, which was insignificant. Iguape agulha had the highest means in plant height, leaf length, and leaf width, while Cateto had the lowest.

*Total number of bearing culms and nonbearing culms*

The number of bearing culms of the 50 representative plants of each of the five varieties (table 4) ranged from  $3.22 \pm .18$  in Iguape agulha to  $4.70 \pm .19$  in Perola. Dourado agulha had  $3.70 \pm .16$ ; Cateto,  $3.74 \pm .18$ ; and Jaguari,  $3.78 \pm .19$  bearing culms. Statistical comparisons of the means of bearing culms (table 15) show that the difference of the means of Perola and that of any of the other varieties was highly significant. When Dourado agulha, Iguape agulha, Cateto, Perola, and Jaguari were compared with one another, it was found that the differences between Dourado agulha and Iguape agulha, between Dourado agulha and Cateto, between Dourado agulha and Jaguari, between Iguape agulha and Cateto, and between Cateto and Jaguari were all insignificant. The differences between the means of Dourado agulha and Perola, of Iguape agulha and Perola, of Perola and Cateto, and of Perola and Jaguari were highly significant. The difference between the means of Iguape agulha and Jaguari was significant.

The number of nonbearing culms (table 5) ranged from  $0.5 \pm 0$  in Dourado agulha and Iguape agulha to  $1.38 \pm .14$  in Cateto. Jaguari had  $1.18 \pm .13$  nonbearing culms, while Perola had only  $0.78 \pm .16$ . Statistical comparisons (table 15) of the data obtained on number of nonbearing culms produced by Cateto and Jaguari and by Dourado agulha, Iguape agulha, and Perola, the three varieties having the lowest means of nonbearing culms, show that the difference between any two of these varieties was insignificant. The difference between the means of Perola and Jaguari was significant, while the differences between the means of Dourado agulha

and Cateto, of Dourado agulha and Jaguari, of Iguape agulha and Cateto, of Iguape agulha and Jaguari, and of Perola and Cateto were highly significant.

The total number of culms (table 6) varied from  $3.70 \pm .21$  in Iguape agulha to  $5.58 \pm .19$  in Perola. Statistical comparisons (table 15) show a highly significant difference between the highest mean total number of culms (Perola) and the lowest (Iguape agulha). The difference between the highest mean and second highest mean (Cateto) was insignificant. The differences between those of Dourado agulha and Iguape agulha, of Perola and Cateto, and of Cateto and Jaguari were insignificant. On the other hand, the differences between the means of the Dourado agulha and Cateto, between Dourado agulha and Jaguari, and between Perola and Jaguari were all significant.

It is interesting to note that Perola led the other varieties in the number of bearing culms and in the total number of culms.

*Flowering and maturity.* The number of days from sowing to flowering (table 7) ranged from  $92.46 \pm .53$ , the earliest, in Dourado agulha to  $96.46 \pm .42$ , the latest, in Cateto. Perola flowered in  $93.70 \pm .39$  days, Jaguari in  $94.34 \pm .53$  days, and Iguape agulha in  $95.42 \pm .55$  days. The number of days from sowing to maturity (table 8) ranged from  $114.66 \pm .54$ , the earliest, in Dourado agulha to  $118.34 \pm .49$ , the latest, in Cateto. Perola matured in  $115.22 \pm .41$  days, Jaguari in  $115.60 \pm .58$ , and Iguape agulha in  $117.18 \pm .64$ .

*Panicle and grain characters.* The lengths of panicles from the tip to the last node of the 50 representative plants (table 9) ranged from  $19.44 \pm .23$  centimeters in Cateto to  $26.07 \pm .36$  centimeters in Iguape agulha. When statistical comparisons (table 16) were made of the different varieties under this criterion, a highly significant difference was found between the highest mean (Iguape agulha) and the lowest (Cateto). Likewise, the differences in the mean length of panicles between Dourado agulha and Iguape agulha, between Dourado agulha and Perola, between Dourado agulha and Cateto, between Iguape agulha and Perola, between Iguape agulha and Cateto, between Iguape agulha and Jaguari, between Perola and Cateto, and between Cateto and Jaguari were highly significant. The difference between the mean of Dourado agulha and that of Jaguari was significant, while that between Perola and Jaguari was insignificant.

The panicles were threshed by hand, cleaned, sorted, and the lengths and widths of 25 grains from each representative panicle of 50 plants of each variety taken. The lengths of grains (table 10) varied from  $9.15 \pm .03$  millimeters in Cateto to  $10.54 \pm .01$  millimeters in Dourado agulha. Statistical comparison (table 16) shows that the difference between the highest mean (Dourado agulha) and the lowest (Cateto) was highly significant. The difference in mean length of grains between any two of the varieties was highly significant.

The widths of grains were quite uniform in each variety. Except in Cateto, which had a mean width of 3.5 millimeters, all the other varieties had a mean width of 3 millimeters.

The number of filled grains (table 11) ranged from  $83.80 \pm 2.81$  in Cateto, to  $119.60 \pm 3.65$  in Jaguari. Statistical comparisons (table 17) of the different varieties show that the difference between the highest mean

(Jaguari) and the lowest (Cateto) was highly significant. However, the differences between the highest mean and the second highest (Perola) and between Dourado agulha and Cateto were not significant. The difference between Dourado agulha and Iguape agulha was significant. The differences between any two of the other varieties were highly significant.

The mean number of empty grains (table 12) varied from  $15.0 \pm 1.15$  in Cateto to  $27.80 \pm 1.51$  in Jaguari. Statistical comparison (table 17) between the highest mean (Jaguari) and the lowest (Cateto) shows a highly significant difference. The difference between the highest mean and the second highest (Perola) was insignificant. Similarly, the difference between Iguape agulha and Perola was insignificant. The differences of the means between Dourado agulha and Iguape agulha, between Dourado agulha and Perola, between Dourado agulha and Cateto, and between Iguape agulha and Jaguari were significant. On the other hand, the differences in the number of empty grains in each panicle between Dourado agulha and Jaguari, between Iguape agulha and Cateto, and between Perola and Cateto were highly significant.

The percentage of filled grains in each panicle ranged from 76.67 per cent in Jaguari to 83.16 per cent in Dourado agulha. Perola had 83.12 per cent; Cateto, 82.11 per cent; and Iguape agulha, 76.67 per cent of filled grains.

Dourado agulha had the lowest percentage of empty grains to the panicle, with an average of 16.84 per cent, while Jaguari had the highest, with an average of 23.33 per cent.

The mean weights of grains to a panicle (table 13) ranged from  $2.76 \pm .10$  grams in Cateto to  $3.72 \pm .09$  grams in Perola. Statistical comparisons (table 17) of the different varieties show that the difference between the highest mean weight (Perola) and the lowest mean weight (Cateto) was highly significant. Statistical difference between the highest mean and the second highest (Dourado agulha) was insignificant; so was the difference between the second highest mean and the third highest mean (Jaguari). Thus, there were no great variations in the weights of grains in a panicle of the varieties Perola, Dourado agulha, and Jaguari.

#### SUMMARY

1. The seedlings in the seedbeds of five Brazilian rice varieties from Campinas, Sao Paulo, Brazil, in their second generation of culture in Los Baños, were quite uniform in external appearance. No pest was seen in the cultures during the seedling stage.

2. The five varieties were erect and nonlodging despite the successive strong winds which prevailed during their vegetative and reproductive periods of growth.

3. The height of plants ranged from  $101.1 \pm 1.23$  centimeters in Cateto to  $123.3 \pm 1.37$  centimeters in Iguape agulha.

4. The number of bearing culms ranged from  $3.22 \pm .18$  in Iguape agulha to  $4.70 \pm .19$  in Perola. Perola produced the greatest number of bearing culms and total number of culms.

5. The number of days from sowing to flowering ranged from  $92.46 \pm .53$  in Dourado agulha to  $96.46 \pm .42$  in Cateto. The number of

days from sowing to maturity varied from 114.66 $\pm$ .54 in Dourado agulha to 118.34 $\pm$ .49 in Cateto. Dourado agulha was the earliest to flower and to mature; variety Cateto, the latest.

6. The length of panicles ranged from 19.41 $\pm$ .23 centimeters to 26.07 $\pm$ .36 centimeters. The differences in mean lengths of panicles between any two of the varieties studied were generally highly significant. However, under this criterion, the difference between Perola and Jaguari was insignificant. The longest panicle variety was Iguape agulha and the shortest, Cateto.

7. The length of grains varied from 9.15 $\pm$ .03 millimeters in Cateto to 10.54 $\pm$ .01 millimeters in Dourado agulha, the difference being highly significant. The mean width of grains varied from 3.0  $\pm$  0 in Dourado agulha, Iguape agulha, Perola, and Jaguari to 3.5 $\pm$ 0 millimeters in Cateto. The number of filled grains varied from 83.80 $\pm$ 2.81 in Cateto to 119.60 $\pm$ 3.65 in Jaguari. The mean number of empty grains ranged from 15.0 $\pm$ 1.15 in Cateto to 27.80 $\pm$ 1.51 in Jaguari.

8. The mean weight of grains in a panicle ranged from 2.76 $\pm$ .10 grams in Cateto to 3.72 $\pm$ .09 grams in Perola.

9. Based on grain characters, tillering, and maturity of the plants, the Brazilian varieties studied may be ranked as follows:

a. The variety Dourado agulha produced the highest percentage of filled grains, the longest grains, and the least number of nonbearing culms. It also produced the heaviest individual weight of grains, and was the second highest in mean weight of grains to a panicle. Furthermore, it flowered and matured the earliest. For these reasons, this variety may be considered the most promising.

b. Variety Perola produced the highest number of bearing culms and the greatest total number of culms to a hill. It also produced the heaviest weight of grains in a panicle. For these reasons, this variety may be considered as the second most promising.

c. Varieties Jaguari and Iguape agulha rank third and fourth in importance. Variety Cateto is the least promising; it gave the least weight of grains in a panicle and the greatest number of nonbearing culms to a hill.

TABLE 1

*Frequency distribution of plant heights of 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETY				
	Paranaíba	Imperatriz	Proença	Cataguá	Jacupiranga
82 — 86	—	—	—	2	—
87 — 91	—	—	—	5	—
92 — 96	—	—	—	6	—
97 — 101	—	—	—	13	3
102 — 106	1	—	1	15	6
107 — 111	5	5	3	5	11
112 — 116	11	10	9	1	13
117 — 121	17	6	10	—	10
122 — 126	9	12	12	3	7
127 — 131	7	10	3	—	—
132 — 136	—	1	5	—	—
137 — 141	—	3	—	—	—
142 — 146	—	2	1	—	—
147 — 151	—	1	1	—	—
Total	50	50	50	50	50

*Variance constants*

Mean	112.9 ±	875.123 3 ± 1.37	123.16 ± 1.242	101.1 ± 1.235	113.2 ± 1.991
S. D.	6.2 ±	620.9 7 ±	97.8 8 ±	88.8 75 ±	875.7 02 ±
C. V.	5.19 ±	519.7 86 ±	786.7 17 ±	717.8 65 ±	865.6 19 ±

TABLE 2

*Frequency distribution of lengths of leaves of 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETIES				
	Dourado agulha	Iguape agulha	Perola	Cateto	Jaguari
<i>centimeters</i>					
25 — 27	—	—	—	10	3
28 — 30	5	2	10	9	6
31 — 33	9	8	5	12	9
34 — 36	10	15	14	15	13
37 — 39	15	9	7	2	5
40 — 42	11	11	8	2	11
43 — 45	—	1	2	—	3
46 — 48	—	—	2	—	—
49 — 51	—	1	2	—	—
52 — 54	—	1	—	—	—
55 — 57	—	2	—	—	—
Total..	50	50	50	50	50

*Variation constants*

Mean...	36.08 ± .334	37.82 ± .830	36.32 ± .776	31.76 ± .518	35.36 ± .694
S. D....	2.37 ± .237	5.88 ± .588	5.49 ± .549	3.66 ± .366	4.92 ± .492
C. V....	5.04 ± .504	15.54 ± 1.554	12.36 ± 1.236	11.52 ± 1.152	13.06 ± 1.306

TABLE 3

*Frequency distribution of widths of leaves of 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETIES				
	Dourado agulha	Iguape agulha	Perola	Cateto	Jaguari
<i>centimeters</i>					
1.2—1.3	6	—	4	6	15
1.4—1.5	14	4	14	18	19
1.6—1.7	16	15	8	19	10
1.8—1.9	6	11	15	5	4
2.0—2.1	5	8	8	2	1
2.2—2.3	3	7	1	—	1
2.4—2.5	—	4	—	—	—
2.6—2.7	—	1	—	—	—
Total . . . .	50	50	50	50	50

*Variation constants*

Mean . .	1.64 ± .037	1.85 ± .030	1.69 ± .035	1.56 ± .027	1.49 ± .031
S. D. . . .	.268 ± .026	.302 ± .030	.254 ± .025	.192 ± .019	.226 ± .022
C. V. . . .	16.34 ± 1.634	16.32 ± 1.632	15.02 ± 1.502	12.30 ± 1.230	14.51 ± 1.451

TABLE 4

*Frequency distribution of bearing culms to a hill produced by 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETIES				
	Dourado agulha	Iguape agulha	Perola	Cateto	Jaguari
0—1	—	—	—	—	—
2—3	20	36	9	24	23
4—5	25	11	28	21	23
6—7	5	2	12	5	3
8—9	—	1	1	—	1
9—10	—	—	—	—	—
Total...	50	50	50	50	50

*Variation constants*

Mean...	3.70	± .163	3.22	± .185	4.70	± .197	3.74	± .186	3.78	± .193
S. D....	1.16	± .116	1.31	± .131	1.40	± .140	1.32	± .132	1.37	± .137
C. V....	30.93	± 3.093	40.09	± 4.009	29.47	± 2.947	34.82	± 3.482	35.86	± 3.586

TABLE 5

*Frequency distribution of nonbearing culms to a hill produced by 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETIES				
	Dourado agulha	Iguape agulha	Perola	Cateto	Jaguari
0—1	50	50	43	29	33
2—3	—	—	7	20	17
4—5	—	—	—	1	—
6—7	—	—	—	—	—
Total...	50	50	50	50	50

*Variation constants*

Mean...	0.5±0	0.5±0	0.78±.161	1.38±.149	1.18±.132
S. D....			1.14±.114	1.06±.106	.94±.094
C. V....			146.15±14.61	76.83±7.683	79.66±7.966

TABLE 6

*Frequency distribution of total number of culms to a hill produced by 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETIES				
	Dourado agulha	Iguape agulha	Perola	Cateto	Jaguari
0 — 1	—	—	—	—	—
2 — 3	14	27	4	14	9
4 — 5	30	18	17	15	26
6 — 7	6	3	27	15	13
8 — 9	—	2	2	5	1
10 — 11	—	—	—	1	1
Total ...	50	50	50	50	50

*Variation constants*

Mean...	4.23	± .172	3.70	± .217	5.58	± .197	5.06	± .293	4.86	± .230
S. D....	1.22	± .122	1.54	± .154	1.39	± .139	2.08	± .208	1.63	± .163
C. V....	28.84	± 2.884	41.61	± 4.161	24.91	± 2.491	41.10	± 4.110	33.53	± 3.335

TABLE 7

*Frequency distribution of days from sowing to flowering of 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETIES				
	Dourado agulha	Iguape agulha	Perola	Cateto	Jaguari
87 — 88	6	—	—	—	6
89 — 90	11	5	8	3	7
91 — 92	11	8	8	4	5
93 — 94	12	10	16	3	5
95 — 96	4	11	10	10	9
97 — 98	1	3	5	19	8
99 — 100	3	5	3	9	7
101 — 102	0	6	—	1	3
103 — 104	2	2	—	1	—
105 — 106	—	—	—	—	—
Total ...	50	50	50	50	50

*Variation constants*

Mean...	92.46	± .533	95.42	± .556	93.70	± .392	96.46	± .426	94.34	± .533
S. D....	3.78	± .378	3.94	± .394	2.78	± .278	3.02	± .302	3.78	± .378
C. V....	4.08	± .408	4.12	± .412	2.96	± .296	3.13	± .313	3.90	± .390

TABLE 8

*Frequency distribution of days from sowing to maturity of 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETIES				
	Dourado agulha	Iguape agulha	Perola	Cateto	Jaguari
108 — 109	3	—	—	—	4
110 — 111	10	2	6	2	6
112 — 113	9	8	8	4	6
114 — 115	12	9	14	3	7
116 — 117	5	10	12	9	10
118 — 119	4	6	4	15	7
120 — 121	2	7	6	7	5
122 — 123	2	4	—	6	5
124 — 125	3	4	—	4	—
Total....	50	50	50	50	50

*Variation constants*

Mean...	114.66 ± .548	117.18 ± .646	115.22 ± .412	118.34 ± .497	151.60 ± .581
S. D....	3.88 ± .388	4.58 ± .458	2.92 ± .292	3.52 ± .352	4.12 ± .412
C. V....	3.20 ± .320	3.90 ± .390	2.54 ± .254	2.97 ± .297	3.56 ± .356

TABLE 9

*Frequency distribution of panicle lengths produced by 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETIES				
	Dourado agulha	Iguape agulha	Perola	Cateto	Jaguari
<i>centimeters</i>					
16.0—16.9	—	—	—	4	—
17.0—17.9	—	—	—	5	—
18.0—18.9	—	—	—	10	1
19.0—19.9	3	—	—	15	—
20.0—20.9	6	—	—	6	8
21.0—21.9	4	3	4	6	4
22.0—22.9	4	2	5	3	5
23.0—23.9	10	7	9	1	13
24.0—24.9	14	6	14	—	11
25.0—25.9	7	7	7	—	4
26.0—26.9	2	7	7	—	2
27.0—27.9	—	6	3	—	2
28.0—28.9	—	4	1	—	—
29.0—29.9	—	3	—	—	—
30.0—30.9	—	4	—	—	—
31.0—31.9	—	1	—	—	—
Total . . .	50	50	50	50	50

*Variation constants*

Mean . . .	23.29	±	.268	26.07	±	.362	24.39	±	.237	19.44	±	.234	24.27	±	.276
S. D. . . .	1.90	±	.190	2.57	±	.257	1.68	±	.168	1.66	±	.166	1.96	±	.196
C. V. . . .	8.11	±	.811	9.84	±	.984	6.88	±	.688	8.53	±	.853	8.07	±	.807

TABLE 10

*Frequency distribution of grain lengths produced by 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETIES				
	Dourado agulha	Iguape agulha	Perola	Cateto	Jaguari
<i>centimeter s</i>					
8.60 — 8.69	—	—	—	1	—
8.70 — 8.79	—	—	—	2	—
8.80 — 8.89	—	—	—	2	—
8.90 — 8.99	—	—	—	10	—
9.00 — 9.09	—	—	—	6	2
9.10 — 9.19	—	—	—	11	9
9.20 — 9.29	—	—	—	6	16
9.30 — 9.39	—	—	2	1	15
9.40 — 9.49	—	—	3	4	6
9.50 — 9.59	—	—	10	4	1
9.60 — 9.69	—	—	13	2	—
9.70 — 9.79	—	—	13	—	1
9.80 — 9.89	—	—	5	1	—
9.90 — 9.99	—	—	1	—	—
10.00 — 10.09	—	—	1	—	—
10.10 — 10.19	—	—	2	—	—
10.20 — 10.29	—	1	—	—	—
10.30 — 10.39	3	14	—	—	—
10.40 — 10.49	11	22	—	—	—
10.50 — 10.59	24	7	—	—	—
10.60 — 10.69	10	4	—	—	—
10.70 — 10.79	1	2	—	—	—
10.80 — 10.89	1	—	—	—	—
Total . . . .	50	50	50	50	50

*Variation constants*

Mean . . .	10.54 ± .013	10.45 ± .015	9.68 ± .021	9.15 ± .036	9.28 ± .017
S. D. . . .	.095 ± .009	.108 ± .018	.149 ± .014	.250 ± .025	.126 ± .012
C. V. . . .	0.90 ± .009	1.03 ± .103	1.539 ± .153	2.79 ± .279	1.34 ± .013

TABLE 11

*Frequency distribution of number of filled grains produced by 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETIES				
	Dourado agulha	Iguape agulha	Perola	Cateto	Jaguari
45 — 54	—	—	—	5	—
55 — 64	—	1	—	5	—
65 — 74	7	1	2	6	2
75 — 84	10	9	1	8	2
85 — 94	12	9	4	15	6
95 — 104	6	14	6	3	4
105 — 114	7	4	14	4	8
115 — 124	4	5	10	3	12
125 — 134	4	2	4	1	2
135 — 144	—	4	3	—	2
145 — 154	—	1	2	—	6
155 — 164	—	—	3	—	4
165 — 174	—	—	1	—	2
Total...	50	50	50	50	50

*Variation constants*

Mean...	90.80 ± 2.89	101.40 ± 2.82	116.20 ± 2.87	83.80 ± 2.81	119.60 ± 3.65
S. D....	20.50 ± 2.050	20.00 ± 2.00	20.36 ± 2.036	19.90 ± 1.990	25.90 ± 2.590
C. V....	22.57 ± 2.257	19.72 ± 1.972	17.52 ± 1.752	23.74 ± 2.374	21.65 ± 2.165

TABLE 12

*Frequency distribution of number of empty grains produced by 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETIES				
	Dourado agulha	Iguape agulha	Perola	Cateto	Jaguari
5—9	8	2	6	9	2
10—14	12	6	6	18	9
15—19	8	16	8	15	6
20—24	10	8	12	2	5
25—29	4	6	4	4	2
30—34	4	4	6	2	10
35—39	2	6	—	—	6
40—44	2	—	4	—	8
45—49	—	2	2	—	2
50—54	—	—	2	—	—
Total...	50	50	50	50	50

*Variation constants*

Mean...	18.40 ± 1.25	22.80 ± 1.20	23.60 ± 1.70	15.00 ± 1.15	27.80 ± 1.20
S. D....	8.90 ± .890	9.55 ± .955	12.10 ± 1.210	8.20 ± .820	10.70 ± 1.070
C. V....	50.00 ± 5.00	41.88 ± 4.188	51.27 ± 5.12	54.00 ± 5.400	38.46 ± 3.846

TABLE 13

*Frequency distribution of grain weights to a panicle produced by 50 plants from each of the five varieties of rice*

CLASS RANGE	VARIETIES				
	Dourado agulha	Iguape agulha	Perola	Cateto	Jaguari
<i>grams</i>					
1.5—1.9	—	2	—	7	2
2.0—2.4	3	14	2	11	4
2.5—2.9	9	18	3	11	7
3.0—3.4	12	6	14	14	17
3.5—3.9	11	7	13	5	7
4.0—4.4	7	3	10	2	8
4.5—4.9	8	—	6	—	5
5.0—5.4	—	—	2	—	—
Total...	50	50	50	50	50

*Variation constants*

Mean...	3.54 ± .103	2.81 ± .088	3.72 ± .097	2.76 ± .104	3.37 ± .187
S. D....	.735 ± .073	.630 ± .0630	.690 ± .0690	.720 ± .0720	.770 ± .0770
C. V....	20.62 ± 2.062	22.41 ± 2.241	18.54 ± 1.854	26.08 ± 2.608	22.84 ± 2.284

TABLE 14  
*Comparative structural differences of the five varieties of rice*

VARIETIES <sup>a</sup>	CHARACTERS	MEAN DIFFERENCE	LEVEL OF SIGNIFICANCE		REMARKS
			5%	1%	
A and B.....	Plant height	4.40	3.25	4.34	Highly significant
A and C.....		4.26	3.03	4.04	Highly significant
A and D.....		17.80	3.01	4.02	Highly significant
A and E.....		5.70	2.65	3.53	Highly significant
B and C.....		0.14	3.69	4.93	Insignificant
B and D.....		22.20	3.69	4.93	Highly significant
B and E.....		10.10	3.39	4.52	Highly significant
C and D.....		22.06	3.49	4.66	Highly significant
C and E.....		9.96	3.17	4.23	Highly significant
D and E.....		12.10	3.15	4.20	Highly significant
A and B.....	Length of leaves	1.74	1.79	2.39	Insignificant
A and C.....		0.24	1.68	2.26	Insignificant
A and D.....		4.32	1.23	1.64	Highly significant
A and E.....		0.72	1.54	2.06	Insignificant
B and C.....		1.50	2.27	3.02	Insignificant
B and D.....		6.06	1.96	2.62	Highly significant
B and E.....		2.42	2.16	2.89	Significant
C and D.....		4.52	1.87	2.50	Highly significant
C and E.....		0.96	2.08	2.78	Insignificant
D and E.....		3.52	1.73	2.31	Highly significant
A and B.....	Width of leaves	0.21	0.070	0.090	Highly significant
A and C.....		0.05	0.100	0.134	Insignificant
A and D.....		0.08	0.090	0.120	Insignificant
A and E.....		0.15	0.096	0.128	Highly significant
B and C.....		0.16	0.092	0.123	Highly significant
B and D.....		0.29	0.080	0.107	Highly significant
B and E.....		0.36	0.086	0.115	Highly significant
C and D.....		0.13	0.088	0.117	Highly significant
C and E.....		0.20	0.092	0.123	Highly significant
D and E.....		0.70	0.082	0.119	Highly significant

<sup>a</sup>A — Dourado agulha

B — Iguape agulha

C — Perola

D — Cateto

E — Jaguari

TABLE 15  
*Comparative structural differences of the five varieties of rice*

VARIETIES <sup>a</sup>	CHARACTERS	MEAN DIFFERENCE	LEVEL OF SIGNIFICANCE		REMARKS
			5%	1%	
A and B.....	Number of bearing culms	0.48	0.48	0.64	Insignificant
A and C.....		1.00	0.50	0.67	Highly significant
A and D.....		0.04	0.48	0.64	Insignificant
A and E.....		0.08	0.50	0.67	Insignificant
B and C.....		1.58	0.54	0.72	Highly significant
B and D.....		0.52	0.52	0.69	Insignificant
B and E.....		0.56	0.52	0.69	Significant
C and D.....		0.96	0.54	0.72	Highly significant
C and E.....		0.92	0.54	0.72	Highly significant
D and E.....		0.04	0.52	0.69	Insignificant
A and B.....	Number of nonbearing culms	0.00	0.00	0.00	Insignificant
A and C.....		0.28	0.32	0.42	Insignificant
A and D.....		0.88	0.28	0.37	Highly significant
A and E.....		0.68	0.26	0.34	Highly significant
B and C.....		0.28	0.32	0.42	Insignificant
B and D.....		0.88	0.28	0.37	Highly significant
B and E.....		0.68	0.26	0.34	Highly significant
C and D.....		0.60	0.42	0.56	Highly significant
C and E.....		0.48	0.42	0.56	Significant
D and E.....		0.20	0.26	0.34	Insignificant
A and B.....	Total Number of culms	0.53	0.54	0.72	Insignificant
A and C.....		1.33	0.52	0.69	Highly significant
A and D.....		0.83	0.66	0.88	Significant
A and E.....		0.63	0.56	0.75	Significant
B and C.....		1.88	0.58	0.77	Highly significant
B and D.....		1.36	0.72	0.96	Highly significant
B and E.....		1.16	0.62	0.83	Highly significant
C and D.....		0.52	0.70	0.93	Insignificant
C and E.....		0.72	0.60	0.80	Significant
D and E.....		0.20	0.74	0.99	Insignificant

<sup>a</sup>A — Dourado agulha

B — Iguape agulha

C — Perola

D — Cateto

E — Jaguari

TABLE 16  
*Comparative structural differences of the five varieties of rice*

VARIETIES <sup>a</sup>	CHARACTERS	MEAN DIFFERENCE	LEVEL OF SIGNIFICANCE		REMARKS
			5%	1%	
A and B.....	Length of panicles	2.78	0.90	1.20	Highly significant
A and C.....		1.10	0.70	0.93	Highly significant
A and D.....		3.85	0.70	0.93	Highly significant
A and E.....		0.98	0.76	1.01	Significant
B and C.....		1.62	0.86	1.15	Highly significant
B and D.....		6.57	0.86	1.15	Highly significant
B and E.....		1.80	0.90	1.20	Highly significant
C and D.....		4.95	0.66	0.88	Highly significant
C and E.....		0.12	0.72	0.96	Insignificant
D and E.....		4.83	0.72	0.96	Highly significant
A and B.....	Length of grains	0.09	0.04	0.05	Highly significant
A and C.....		0.86	0.04	0.05	Highly significant
A and D.....		1.39	0.06	0.08	Highly significant
A and E.....		1.26	0.04	0.05	Highly significant
B and C.....		0.77	0.04	0.05	Highly significant
B and D.....		1.30	0.08	0.10	Highly significant
B and E.....		1.17	0.04	0.05	Highly significant
C and D.....		0.53	0.06	0.08	Highly significant
C and E.....		0.40	0.04	0.05	Highly significant
D and E.....		0.13	0.06	0.08	Highly significant

<sup>a</sup>A — Dourado agulha

B — Iguape agulha

C — Perola

D — Cateto

E — Jaguari

TABLE 17  
Comparative structural differences of the five varieties of rice

VARIETIES <sup>a</sup>	CHARACTERS	MEAN DIFFERENCE	LEVEL OF SIGNIFICANCE		REMARKS
			5%	1%	
A and B.....	Number of filled grains	10.60	8.09	10.80	Significant
A and C.....		25.40	8.17	10.90	Highly significant
A and D.....		7.00	8.09	10.80	Insignificant
A and E.....		28.80	9.34	12.46	Highly significant
B and C.....		14.80	8.07	10.77	Highly significant
B and D.....		17.60	7.99	10.66	Highly significant
B and E.....		18.20	9.26	12.35	Highly significant
C and D.....		32.40	8.05	10.74	Highly significant
C and E.....		3.40	9.32	12.43	Insignificant
D and E.....		35.80	9.24	12.32	Highly significant
A and B.....	Number of empty grains	4.40	3.47	4.63	Significant
A and C.....		5.20	4.23	5.65	Significant
A and D.....		3.40	3.39	4.52	Significant
A and E.....		9.40	4.42	5.89	Highly significant
B and C.....		0.80	4.17	5.57	Insignificant
B and D.....		7.80	3.33	4.44	Highly significant
B and E.....		5.00	4.36	5.81	Significant
C and D.....		8.60	4.11	5.49	Highly significant
C and E.....		4.20	4.98	6.64	Insignificant
D and E.....		12.80	4.29	5.73	Highly significant
A and B.....	Weight of grains	0.73	0.26	0.34	Highly significant
A and C.....		0.18	0.28	0.37	Insignificant
A and D.....		0.78	0.28	0.34	Highly significant
A and E.....		0.17	0.42	0.56	Insignificant
B and C.....		0.91	0.26	0.34	Highly significant
B and D.....		0.05	0.26	0.34	Insignificant
B and E.....		0.56	0.40	0.53	Highly significant
C and D.....		0.96	0.30	0.40	Highly significant
C and E.....		0.35	0.42	0.56	Insignificant
D and E.....		0.61	0.42	0.56	Highly significant

<sup>a</sup>A — Dourado agulha

B — Iguape agulha

C — Perola

D — Cateto

E — Jaguari

## AN OUTSTANDING INTRODUCED VARIETY OF SUGAR CANE<sup>1</sup>

VALERIANO C. CALMA AND FEDERICO V. RAMOS

*Of the Department of Agronomy*

The introduction of foreign varieties is one of the methods of improving the yield of sugar cane. One of the varieties of sugar cane introduced into this College in 1939 excelled in performance the leading varieties in culture in the Philippines. This outstanding variety was compared with three standard varieties in the Philippines, namely, POJ 2878, P.S.A. 7, and P.S.A. 14, in yield of cane and sugar, and of sugar in each ton of cane. The work was conducted from October, 1947, to April, 1949, in the Experiment Station and in the laboratories of the Departments of Agronomy and Agricultural Chemistry of this College.

The outstanding introduced variety is referred to here as "College 39" because it is one of the several varieties of sugar cane introduced in this College in 1939 by Dr. Leon G. Gonzalez. The origin of this variety, however, cannot be stated definitely owing to the destruction of the records of the Department of Agronomy when the College was burned by the Japanese on February 26 and 27, 1945. Calma<sup>2</sup> first used the name "College 39" for this introduced variety to denote that it was brought into the Philippines in 1939, and was in continuous culture and study in the College since that time. It was found to outrank all known varieties. Calma characterizes this outstanding variety as a greenish-white cane, turning yellowish white, and with blotches or red spots on the rind when mature. The stalks are erect and remain so unless blown down by strong winds. The stalks have large internodes which are of medium length. The variety stools fairly well. It is resistant to pests and diseases. It arrows slightly and late, and matures in about 12 to 14 months.

In the experiment, cut-back seed pieces of College 39 with three or more nodes were collected from stalks about six months old. The cuttings were planted on clay loam soil, 50 cm. from each other in furrows 1.4 m. apart, for comparison in performance with ordinary top seed pieces or points of POJ 2878, P.S.A. 7, and P.S.A. 14 sugar cane.

The sugar-cane plants were cultivated by alternate hilling up and off-baring with a Ford Ferguson tractor. When the plants were about three months old, they were fertilized with ammonium sulfate applied at the rate of 10 grams to each hill, or 150 kilograms to the hectare. Whenever necessary, the plants were cultivated and weeded.

From the time the canes were about 10 months old the maturity of the four varieties was determined weekly with a hand refractometer. When the canes were mature, all of the millable stalks were cut at the base close to the ground and the tops cut off. The percentage of stand was determined

<sup>1</sup>Experiment Station Contribution No. 1544.

Read by the senior author before the Los Baños Biological Club, September 30, 1949.

<sup>2</sup>Calma, Valeriano C. 1949. College 39, a promising variety of sugar cane new to the Philippines. *Sugar News* 25: 470.

by counting the number of missing hills in the field. The variability of number and weight of millable stalks of each stool were determined by taking at random 10 stools or hills of each variety.

Ten representative millable stalks from the 10 stools of each variety, taken at random, were crushed in a hand mill, and the Brix and the percentage of polarization of the juice were taken with a Bausch and Lomb saccharimeter. The analyses were made in the Department of Agricultural Chemistry, with the cooperation of Assistant Professor Leopoldo J. Villanueva, to whom the writers are indebted.

#### RESULTS AND DISCUSSION

According to hand-refractometer readings, the four varieties were mature on February 14, 1949, when they were about 12 months of age. The early maturity was perhaps due to the dry weather that prevailed when the canes were 11 to 12 months old. Even the supposedly late-maturing varieties were mature, so all four varieties were harvested at the age of about 12 months.

The results presented in tables 1 to 4 show that the number of millable stalks to a stool of the four varieties varied from 6.1 to 8.5; College 39 had the greatest number. All four varieties, however, did not differ significantly in number of millable stalks to a stool.

In weight of millable stalks in a stool, College 39 had a mean of 17.99 kilograms; this variety significantly produced the heaviest millable stalks in a stool. The average weight of millable stalks in a stool of the other three standard varieties of sugar cane used for comparison varied from 9.12 to 10.01 kilograms; the differences were not significant.

In purity of juice (table 3) the four varieties showed that College 39 had the highest, 90.93 per cent; POJ 2878, the lowest, 84.83 per cent.

The different agronomic characters of the four varieties are summarized in table 4. College 39 had the lowest percentage of stand, only 42.30, whereas POJ 2878, P.S.A. 7, and P.S.A. 14 had practically the same stand, from 59.30 to 61.30 per cent. The low stand of the plants of the four varieties in the field was perhaps due to inadequate moisture in the soil caused by the late planting on March 2 to 5, 1948. The very much lower percentage of stand of College 39 may be due to the fact that cut-back seed pieces were used as seed. This result is a corroboration of an earlier finding by one of us<sup>3</sup> that the germination of cut-back seed pieces is not so good as that of the top seed pieces when the moisture content is below the optimum.

On account of the high percentage of dead plants, College 39 had the lowest number of hills in a hectare, whereas the POJ 2878, P.S.A. 7, and P.S.A. 14 had practically the same number. Although it had the lowest number of hills, 42.3 per cent, College 39 had the highest computed tonnage of cane, 108 tons to the hectare. It had not only significantly heavier canes in each stool than any of the three standard varieties but also the highest computed yield of canes in a hectare. POJ 2878 and P.S.A. 14 had each a computed yield of 87.6606 tons cane a hectare and P.S.A. 7, the lowest with only 71.261 tons.

<sup>3</sup>Calma, Valeriano C. 1932. Studies on germination, degree of tillering and vigor of plants of top and cut-back seedpieces of POJ 2878 sugar cane (*Saccharum officinarum*). Philippine Agriculturist 21: 585-612.

College 39 outyielded all the three standard varieties in piculs of sugar a hectare; it gave an estimated yield of 258.33 piculs. P.S.A. 7 and POJ 2878 had practically the same yield of sugar and P.S.A. 14, the lowest, 187.43 piculs a hectare. The juice of a mixture of about one-fourth College 39 and three-fourths P.S.A. 7, or a total of 24.225 tons, milled at the Canlubang Sugar Estate, gave a purity of 92.78 per cent and 2.17 piculs of sugar in a ton of cane. The juice of a mixture of about one-seventh of POJ 2878, two-sevenths of P.S.A. 14, and four-sevenths of P.S.A. 7, or a total of 22.65 tons, gave 85.18 per cent purity and 1.69 piculs sugar in a ton of cane. All results indicate that College 39 has a high purity.

#### SUMMARY

1. The four varieties of sugar cane compared, namely, College 39, POJ 2878, P.S.A. 7, and P.S.A. 14 were mature 12 months after planting.
2. The four varieties did not show any significant difference in the number of millable stalks in a stool.
3. College 39 produced significantly heavier millable stalks in a stool than any of the three varieties used for comparison.
4. College 39 gave the highest computed yield of cane to a hectare, the highest purity of juice, 90.93 per cent, and the highest computed yield of sugar, 258.33 piculs a hectare.

TABLE 1  
Comparative number of millable stalks to a stool

VARIETY	REPLICATION										TOTAL	MEAN
	1	2	3	4	5	6	7	8	9	10		
College 39	8	11	6	9	10	6	7	6	12	10	85	8.5
POJ 2473	6	7	5	9	3	7	5	9	4	6	61	6.1
P.S.A. 7	7	4	7	5	6	11	7	11	6	7	71	7.1
P.S.A. 14	8	8	4	4	5	6	6	4	12	5	62	6.2
Total	29	30	22	27	24	30	25	30	34	28	279	
Mean	7.2	7.5	5.5	6.7	6.0	7.5	6.2	7.5	8.0	7.0		

*Analysis of variance*

SOURCE OF VARIATION	DF	SUM OF SQUARES	VARIANCE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Varieties	3	37.10	12.37	2.080	2.86	4.38
Error	36	213.88	5.94			
Total	39	250.98				

TABLE 2  
Comparative weight in kilograms of millable stalks to a stool

VARIETY	REPLICATION										TOTAL	MEAN
	1	2	3	4	5	6	7	8	9	10		
College 39	17.8	25.4	13.4	22.0	22.8	12.5	13.8	8.8	23.4	20.0	179.9	17.99
POJ 2878..	10.2	15.2	7.7	10.7	6.4	10.1	7.6	11.8	7.0	13.4	100.1	10.01
P.S.A. 7	11.0	5.8	8.6	5.8	7.5	15.6	11.2	10.2	7.5	8.0	91.2	9.12
P.S.A. 14	7.6	11.8	3.8	4.4	8.2	9.6	8.6	7.5	21.4	9.0	91.9	9.19
Total ....	46.6	58.2	33.5	42.9	44.9	47.8	41.2	38.3	59.3	50.4	463.1	
Mean ....	11.65	14.55	8.2	10.7	11.2	14.95	10.3	9.6	14.8	12.6		

*Analysis of variance*

SOURCE OF VARIATION	DF	SUM OF SQUARES	VARIANCE	COMPUTED F-VALUE	TABULAR F-VALUE	
					5%	1%
Varieties .....	3	553.167	184.39	10.19	2.86	4.38
Error.....	36	650.72	18.07			
Total.....	39	1203.89				

L. S. M. D. = 3.9521

TABLE 3  
*Comparative analyses of the juice*

VARIETY	CORRECTED BRIX	CORRECTED POLARIZATION	PURITY	SUCROSE IN CANE
	<i>degree</i>	<i>per cent</i>	<i>per cent</i>	<i>per cent</i>
College 39.....	21.92	83.42	90.93	16.31
POJ 2878.....	18.80	65.93	84.83	14.55
P.S.A. 7.....	20.84	78.43	90.47	16.86
P.S.A. 14.....	22.19	82.92	89.16	13.07

TABLE 4  
*Summary of agronomic data of the four varieties*

VARIETY	STAND OF PLANTS IN THE FIELD	NO. OF HILLS PER HECTARE		WEIGHT OF MILLABLE STALKS		WEIGHT OF SUGAR	
		Actually planted	with living plants	Per stool	Per hectare	Per ton cane <sup>a</sup>	Per hectare
	<i>per cent</i>			<i>kgm.</i>	<i>tons</i>	<i>piculs</i>	<i>piculs</i>
College 39.....	42.30	14,286	6,042.9	17.99	108.7142	2.36	258.3307
POJ 2878.....	61.30	14,286	8,757.3	10.01	87.6606	2.12	185.8513
P.S.A. 7.....	59.30	14,286	8,471.6	9.12	77.2610	2.45	189.8212
P.S.A. 14.....	61.30	14,286	8,757.3	9.19	87.6606	1.91	167.4317

<sup>a</sup>Sugar per ton cane was calculated from data on percentage of sucrose in juice and 96% extraction in the mill and 96% boiling house recovery.

## THE USE OF THE SUN PORCH FOR LAYING PULLETS<sup>1</sup>

AMADO C. CAMPOS

*Of the Department of Animal Husbandry*

Successful poultrymen in the more progressive communities in the United States have learned to eliminate their yarding problems by providing the birds with sun porches adjacent to the poultry houses, thereby permitting the birds to receive the benefits derived from direct sunlight without coming in contact with contaminated soil. Thus, when a considerable number of chickens are kept, the most important factor afforded by the natural range, which is direct sunlight, is taken advantage of without incurring its relevant hazards. To determine the practicability of the use of the sun porch for layers under local conditions, this study was conducted in the Department of Animal Husbandry from May, 1947, to May, 1948.

Kennard and Bethke<sup>2</sup> in 1929 reported that in the Agricultural Experiment Station at Ohio, pullets raised in confinement without contact with the soil and kept in laying houses free from intestinal parasites, maintained better egg production and incurred less mortality than those raised in the ordinary way. They further stated that breeders kept under the same conditions produced eggs of better hatchability and more vigorous chicks. In support of these findings, Newlon and Asmundson<sup>3</sup> in 1943 suggested that in places where land values are high, or when enough land is not available to provide yards of reasonable size, or where the soil is extremely heavy and the drainage poor, the confinement method with sun porches made of wire or slat is recommended. On the other hand, Kennard and Chamberlain<sup>4</sup> in 1936 reported that in a five-year test on the so-called sanitation management procedure on ready-to-lay pullets kept in laying houses with access to different outdoor provisions, namely, wire sun porches covered with fly screen, open-wire sun porches, used ranges, fresh ranges, and pullets kept in batteries, the rates of mortality of the pullet layers were almost the same in all cases regardless of the type of management. In the Philippines Castillo<sup>5</sup> in 1948 found that for brooding chicks, no apparent advantage was derived from the use of the sun porch over that of the ground run.

<sup>1</sup>Experiment Station Contribution No. 1545. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, October, 1948. No. 1590. Prepared in the Department of Animal Husbandry under the direction of Professor F. M. Fronda.

<sup>2</sup>KENNARD, D. C., AND R. M. BETHKE. 1929. Keeping chickens in confinement. Ohio Agric. Exper. Sta. Bull. 437: 1-27.

<sup>3</sup>NEWLON, W. E., AND V. S. ASMUNDSON. 1943. Brooding and rearing chickens. California Agric. Ext. Serv. Cir. 127: 1-56.

<sup>4</sup>KENNARD, D. C., AND V. D. CHAMBERLAIN. 1936. Eight years' experience with losses of layers. Ohio Agric. Exper. Sta. Bull. 21 (189): 63-69.

<sup>5</sup>CASTILLO, LEOPOLDO S. 1948. A study of the influence of two chick rations and two methods of brooding on the rate of growth and mortality of chicks. Philippine Agriculturist 32: 123-136.

## MATERIALS AND METHODS

Eighty Single Comb White Leghorn pullets about five and one-half months old were used in this study. The pullets were divided into two lots, each containing 40 birds, and housed in two adjoining pens under one roof. Lot I was provided with a rectangular ground run, five meters wide and eleven meters long, and surfaced with gravel. There was a little vegetation in this lot. Lot II was allowed a sun porch that had a floor of bamboo slats. The sun porch had the same dimensions as the yard of lot I. The floor of both pens was concrete and covered with a thick litter of rice hulls. Both lots were given the College pullet mash, which consisted of the following ingredients, all parts by weight:

Rice bran.....	40
Copra meal.....	30
Shrimp meal.....	20
Ground corn.....	10

This mash mixture, in dry form, as well as finely ground shell and grit, was made accessible to the birds at all times. In addition, cracked corn in the proportion of about one half of the mash was fed morning and afternoon. Chopped green feed was given to both lots *ad libitum*.

The initial and monthly weights of the birds for twelve months were taken with an "Ohaus" balance having a maximum capacity of 2000 grams. The trapnest records of all the birds, the amount and cost of feed consumed, and the mortality in both lots were recorded.

## RESULTS AND DISCUSSION

*Egg production.* Table 1 shows the comparative egg production of the two lots during the year. It may be seen in this table that lot I produced a total of 5879 eggs, or 46.5 per cent, while lot II produced only 4861 eggs, or 40.3 per cent. On the basis of individual egg production, the average annual egg production of lot I was 170.2 eggs, and that of lot II, 147.5 eggs.

As regards the distribution of egg production, lot I had consistently higher percentages of production except in the eleventh month when it had only 47.8 per cent against the 49.1 per cent of lot II. It may also be noted in table 1 that in both lots the rate of egg production gradually decreased during the third and fourth months. This was expected because this period covered the peak of the molting season of the pullets. The birds in both pens, however, began to pick up production after their molt, the picking up coinciding with favorable weather conditions. The rates of increase in production reached their peak on the seventh laying month in lot I and on the ninth in lot II. The highest monthly percentages of egg production were 64.1 in lot I and 60.2 in lot II. On the tenth month, owing to the unavailability of animal protein supplement, the effect of protein deficiency in the ration was manifested by an abrupt fall in egg production in both lots. A subsequent recovery in production during the last two months of the study was registered when fish meal became available. On the whole, the pullets allowed the ground run exceeded the sun porch pullets in annual egg production by an average of 6.2 per cent or 22.7 eggs.

*Feed consumption and cost.* The birds in lot 1 consumed 760.5 kgm. of mash and 348.0 kgm. of grain, or a total of 1108.5 kgm. of feeds during

the year (table 2). At the current price of feeds, a kilogram of the ration cost 26 centavos. The total cost of feeds consumed by the ground-run-lot birds was therefore ₱288.21. Computed on the basis of the individual bird, the average feed consumption of the birds in lot I was 31.1 kgm. of feed a year, valued at ₱8.09. On the other hand, the sun-porch lot consumed 702.5 kgm. mash mixture and 300.5 kgm. of the grain supplement, or a total feed consumption of only 1003.0 kgm. valued at ₱260.78. The average feed consumption of a bird during the year was 30.4 kgm., valued at ₱7.90.

Regarding the amount of feed consumed and the total number of eggs produced, lot I (the ground-run lot) required 2.26 kgm. of feed and lot II (the sun-porch lot), 2.47 kgm. to produce a dozen eggs. Thus, at prevailing prices, the birds in lot I required feed costing 59 centavos to produce a dozen eggs, and those in lot II, 64 centavos.

*Mortality and average weight of the birds.* Table 3 shows the percentage of mortality in both lots. It may be noted that 13 pullets, or 32.5 per cent, in lot II, and only 8, or 20.0 per cent, in lot I died during the year. During the early part of the experiment, 7 birds in the ground-run lot and 8 in the sun-porch lot died of a disease that appeared to be roup. These deaths comprised 75 per cent and 53.9 per cent of the total mortality in lot I and lot II, respectively.

About the middle of the study, one bird in lot II died of an undetermined cause, and during the last months, two birds in the same pen died of a slow emaciating disease suspected to be tuberculosis. Two other birds in this lot met death when by accident their necks were caught between loosened slats in the floorings. Likewise, in lot I, one more bird died of egg bound the very last day of the experiment. The egg taken from the oviduct of this bird was of regular size, but the bird was not able to expel it.

In general, the birds in the two lots increased in body weight. The average increase of each of the ground-run pullets was 316 grams and that of each of the sun-porch pullets was 299 grams. These figures comprised 24.3 per cent and 23.6 per cent of the initial weights of the birds in lot I and lot II, respectively. There was no appreciable difference in the weights of the birds in both lots.

#### SUMMARY

1. The pullets provided with a sun porch were slightly inferior in egg production to those provided with a ground run.
2. There was no appreciable difference in the amount of feed consumed by each bird in both lots.
3. It required 2.26 kgm. of feed to produce one dozen eggs in the ground-run lot and 2.47 kgm. in the sun-porch lot.
4. There was no significant difference in the gain in weight made by the birds in both lots.
5. The rate of mortality was markedly higher in the sun-porch lot than in the ground-run lot.
6. There was no apparent advantage in the use of sun porch over that of the ground run.

TABLE 1  
*Distribution of egg production in the two lots*

PERIOD	LOT I	LOT II
	Percentage production	Percentage production
May 12 to June 11.....	41.9	34.8
June 12 to July 11.....	45.8	36.7
July 12 to Aug. 11.....	31.7	25.5
Aug. 12 to Sept. 11.....	24.8	18.6
Sept. 12 to Oct. 11.....	35.1	20.4
Oct. 12 to Nov. 11.....	50.8	50.4
Nov. 12 to Dec. 11.....	64.1	55.0
Dec. 12 to Jan. 11.....	63.7	53.4
Jan. 12 to Feb. 11.....	61.5	60.2
Feb. 12 to Mar. 11.....	38.8	36.2
Mar. 12 to April 11.....	47.8	49.1
April 12 to May 11.....	57.5	50.6
Total production for the year.....	5,879	4,861
Annual egg production per bird.....	170.2	147.5
Annual percentage of production.....	46.5	40.3

TABLE 2  
*Amount and cost of feed consumed*

ITEMS	LOT I	LOT II
Amount of feed consumed		
Mash, kilograms.....	760.5	702.5
Grain, kilograms .....	348.0	300.5
Cost of feed consumed <sup>a</sup> , pesos.....	288.21	260.78
Average feed consumption per bird during the year, kilograms.....	31.1	30.4
Total number of eggs produced .....	5879	4861
Amount of feed needed to produce one dozen eggs, kilograms .....	2.26	2.47
Cost of feed needed to produce one dozen eggs, pesos	0.59	0.64

<sup>a</sup>The average cost per kilogram of mash mixture and grain was 26 centavos.

TABLE 3

*Number and weights of the birds at the beginning and at the end of the experiment*

ITEMS	LOT I	LOT II
Number of birds at the beginning, May 12, 1947....	40	40
Average weight of the birds at the beginning, grams.	1302	1266
Number of birds at the close, May 11, 1948.....	32	27
Average weight of the birds at the close, grams.....	1618	1565
Average increase in weight, grams.....	316	299
Percentage increase in weight.....	24.3	23.6
Number of birds that died during the year.....	8	13
Percentage of mortality during the year.....	20.0	32.5

# THE FOOD SUPPLY AND POPULATION OF THE PHILIPPINES <sup>1,2</sup>

FRANCISCO M. SACAY

*Of the Departments of Agricultural Education and Agricultural Economics*

WITH THREE TEXT FIGURES

Since time immemorial, mankind has been trying to eat and live better. At the present time, however, the spectre of starvation is still hovering over a large section of the world's population. In certain areas of the globe, the race between population and food supply has remained as keen as ever. We in the Philippines should take frequent inventories of our food resources. Only by having a full understanding of the food supply situation in this country in the past and in recent years can we formulate adequate plans to meet the food requirements of our rapidly growing population. This paper attempts to present a picture of the food supply situation in this country before and after World War II.

## *Method of study*

The total supply of a foodstuff was obtained by adding the quantity produced and the quantity imported, and making adjustment due to increase or decrease of the amount in stock. From this total were deducted the quantity used for seed, feed, industrial and nonfood uses, and the amount exported. The remainder was the amount available for human consumption. This is not necessarily the quantity actually consumed. The latter may be smaller because of wastage in preparation, cooking, and eating. By dividing the total supply available for human consumption by the total population, the amount per person, or the national average, was obtained.

This method of estimating the level of food consumption is called the "balance sheet" method. It was employed during World War II by the United States, England, and Canada in estimating the consumption level of the population, which served as basis of an equitable distribution of foodstuffs in short supply among the allied countries. The reliability of averages obtained is, of course, dependent upon the accuracy and completeness of national statistics. The method, however, provides a way of estimating the general condition of food supply and consumption in a country and furnishes a basis upon which national programs of food production may be formulated. For a complete picture of the diet and nutrition of different population groups, dietary surveys have to be undertaken.

Data used in this study were gathered from all available sources; namely, the Bureau of the Census and Statistics, the Bureau of Plant Industry, the Bureau of Animal Industry, the Bureau of Fisheries, the Bureau of Customs, the National Rice and Corn Corporation, the Philippine Sugar

<sup>1</sup>General Contribution No. 793.

<sup>2</sup>Read before the Section of Statistics, Section of Nutrition, and Division of Agriculture and Forestry of the National Research Council of the Philippines on October 15, 1949.

Administration, and the National Coconut Corporation. Data on the supply of certain vegetable crops were secured by means of a questionnaire sent to provincial agricultural supervisors. Data appearing in census reports were also utilized.

#### FINDINGS AND DISCUSSION

##### *Estimated prewar food supply*

The amount of foodstuffs available for human consumption before World War II, according to available data and estimates, is shown in table 1. Not included in this table are salt, cacao, coffee, and alcoholic beverages. Prewar figures refer, in most cases, to the average of the five-year period, 1935-39. In some cases the 1939 data were used because figures for other years were not available.

*Cereals.* The estimated amount of rice available for human consumption was 89.7 kilograms per person per year. Less than 4 per cent of this amount was imported. If only the "rice-eating" population is considered, which is estimated at 72 per cent of the total population, the quantity of rice available for consumption per person per year amounts to 124.5 kilograms, or about 341 grams per day.

The prewar supply of corn per person per year was 25.2 kilograms. This five-year average is lower than the average for 1939 or 1940 because of the rapid increase in our corn production since 1935. In addition to rice and corn, other cereal products were imported on an average of 5.9 kilograms per person. This consisted mainly of wheat flour. The total rice and cereal products available for human consumption amounted to 120.8 kilograms per person, of which 7.8 per cent was imported.

*Roots and sugar.* In addition to cereals, there was a supply of root and tubers averaging 36.6 kilograms per person. This consisted mainly of sweet potato and cassava. Cereals and roots totaled over 157.4 kilograms, or more than one half of the total amount of foodstuffs available per person.

In the case of sugar, the amount for human consumption before the war was 10.8 kilograms per person per year, of which about 2 per cent was imported. Although the local consumption was only about one fifth of our production, we imported a certain quantity of refined sugar, candy, and syrup.

*Pulses, vegetables, and fruits.* Vegetables and fruits contributed the next biggest items to the diet. The prewar average was 32.5 and 37.8 kilograms, respectively, per person per year. The figure for vegetables includes not only cultivated vegetables, such as cabbages and pechay, but also banana blossoms, kangkong, sweet potato tops, young leaves and pods, flowers, shoots, and various kinds of greens used as vegetables.

The fruits that were consumed consisted largely of bananas. Other fruits consumed in large quantities were papaya, mango, and jackfruit. Although we exported a big amount of canned pineapple, we also imported canned fruits other than pineapple and fresh fruits amounting to one-half per cent of the total supply. The prewar supply of pulses and nuts is estimated at 8.8 kilograms per person.

*Fish, meat, dairy products, and fats.* The Filipinos are considered a fish-eating rather than a meat-eating people. Estimates on the amount of fish products consumed per person vary. The consumption per person before the war may be placed at 20.3 kilograms, of which about 5 per cent was imported. The amount of meat and poultry consumed before the war was 13.9 kilograms, which is far below the desired amount. The supply came largely from local sources; only about 2 per cent was imported. The egg consumption was only 1.6 kilograms per person. This is equivalent to about 28 eggs per year, or only one-half egg per week. The consumption of milk and cheese was 1.9 kilograms. About 74 per cent of the dairy products was imported, showing that we depended largely upon foreign countries for these commodities. If the imported evaporated and condensed milk and other dairy products are reduced to fresh milk basis, the average consumption would reach 3.5 kilograms. This is hardly four quarts per capita per year.

The consumption of oils and fats amounted to 2.1 kilograms per person, of which 5 per cent was imported. Although the amount of vegetable lard and oleomargarine exported was greater than the quantity of edible vegetable oil purchased from abroad, a certain percentage of the amount imported was consumed locally.

*Consumption and value of imported foodstuffs*

The amount of imported foodstuffs for human consumption before World War II is shown in table 2. Before the war, we were not far from being self-sufficient in foodstuffs. The percentage of importation of each of the various food groups did not exceed 5 per cent, with the exception of wheat flour, vegetables, oils, and dairy products. The biggest importation was that of wheat flour, which averaged 5.6 kilograms per person. This was greater than the importation of rice, which averaged 3.4 kilograms per person. Besides rice and flour, we also imported other cereal products, such as biscuits and macaroni, amounting to 0.4 kilogram per person. The total importation of rice and other cereals and cereal products was 9.4 kilograms per person.

Of the other foodstuffs imported, the total amount was 6.7 kilograms per person. The foodstuffs imported in amounts averaging 1 or more kilograms per person are the following: vegetables, 1.7 kilograms; milk and cheese, 1.4; roots and tubers, 1.1; and fish products, 1. Only very small quantities of imported sugar, pulses, eggs, and oils and fats were consumed per person.

The value of imported foodstuffs is shown in table 3. In the fiscal year 1939-40, the total value was almost 47 million pesos, comprising about 16 per cent of the total value of our imports. Dairy products headed the list, with a value of over 9 million pesos; and rice, almost 6 million pesos. We imported more than 16 million pesos worth of rice and other cereals. Our importation of dairy products, meat, poultry, and eggs was valued at over 12 million pesos. Imported vegetables and fish products were each valued at about 4 million pesos. Over three million pesos worth of fruits was also imported.

*Estimated postwar food supply*

The estimated amount of the different foodstuffs available for human consumption in 1947-48, sometimes referred to as postwar period, is also shown in table 1. Rice available per person in 1947-48 decreased to 76.5 kilograms, of which more than 4 per cent was imported. On the other hand, there was a slight increase in corn and wheat flour available per person. The total rice and cereal products amounted to 108.4 kilograms, of which about 9 per cent was imported. In 1947-48, a larger proportion of the supply of these foodstuffs came from importation.

There was a slight increase in the supply per person of sugar, vegetables, and fish products in 1947-48. In the case of milk and cheese, the increase was due primarily to importation; 88 per cent of the amount available for consumption was imported in 1947-48, as compared with 74 per cent before the war. A decrease in the amount available per person was noted in the case of roots, pulses and nuts, fruits, meat, eggs, and oils and fats.

*Ratio of postwar to prewar supply*

With few exceptions, the quantity of foodstuffs that went into human consumption per person was less in 1947-48 than in the prewar period (table 1). In the case of rice, the amount available for consumption in 1947-48 was about 86 per cent of prewar. If all cereals are taken into account, the postwar supply was about 90 per cent of prewar. Meat supply decreased to 63 per cent. The increase in the supply per person of certain foodstuffs was very small. Corn increased about 4 per cent; fish products, 9 per cent; sugar, over 6 per cent; and vegetables, 8 per cent. The greater supply and consumption of milk per person in 1947-48 was due to increased importation. If all the various food groups are combined, the total in 1947-48 was almost 92 per cent of the prewar quantity.

*Postwar importation of foodstuffs*

Except in the case of corn, roots, and oils and fats, the ratio of imported foodstuffs to total supply increased in 1947-48 (table 1). This was especially true with sugar, fruits, fish products, eggs, and milk and cheese. With the exception of roots and oils and fats, imported foodstuffs consumed in 1947-48 also increased (table 2). Although population was greater in 1947-48 than before World War II, the consumption per person of many of these imported foodstuffs was higher. This was especially the case with fruits, vegetables, fish products, eggs, and milk and cheese. In the case of rice, however, the total quantity imported was higher in 1947-48, but the amount of imported rice consumed per person was slightly lower because of increased population. The ratio of imported rice to total supply available for consumption was higher in 1947-48. If all the cereals are taken together, the amount imported as well as the percentage of importation was greater in 1947-48 than in the prewar period.

The value of imported foodstuffs in the calendar years 1947 and 1948 is shown in table 3. The total value was over 245 million pesos in 1947 and almost 252 million pesos in 1948. This comprised about 24 per cent of the total value of imports in 1947 and nearly 25 per cent in 1948. The reduc-

tion in our dollar resources has been brought about partly by increased purchases of foodstuffs abroad to meet the country's food requirements. This became necessary because of our inability to produce them in sufficient quantities. On the basis of value, the important foodstuffs that we imported in 1947 and 1948 were cereals, livestock products, fish products, fruits, and vegetables.

*Growth of rice and corn production in relation to population*

The growth of rice and corn production in the Philippines since 1910 is shown in table 4. This table presents the area planted to rice and corn and to two important export crops, coconut and sugar cane. The index number of the area planted to each of these crops reveals their status from year to year (fig. 1). The rate of growth of the area planted to these crops

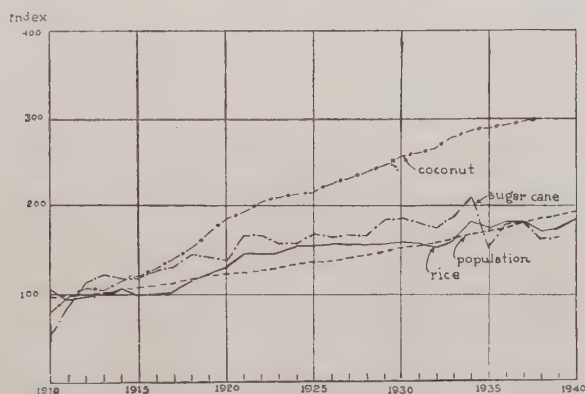


Fig. 1—Index number of area planted to rice, sugar cane, and coconut (1910-14 =100)

from 1910 to 1938 was as follows: rice, 2.3 per cent; corn, 2.2; sugar cane, 2.1; and coconut, 4.0. The rate of growth in the area planted to corn and rice was almost the same as that of the human population, which was about 2.2 per cent. On the other hand, the coconut area increased at the rate of 4 per cent and sugar cane, at the rate of 2.9 per cent from 1910 to 1934. We would have been completely self-sufficient in rice before World War II if part of the area planted to export crops had been put under rice cultivation. This was not done because of the attractive income that could be derived from the production of export crops, particularly sugar cane and coconut.

*Trend of rice production and rice and flour importation*

The quantities of rice produced and imported from 1910 to 1948 and the corresponding index numbers are shown in table 5. The production of rice was increasing and the importation was decreasing up to the outbreak

of the war (fig. 2). Rice production from 1910 to 1938 increased at the rate of 3.4 per cent and rice importation decreased at the rate of 7.3 per cent. The increase in rice production was brought about not only by the expansion in area, which increased at the rate of 2.3 per cent, but also by a higher yield per hectare.

While rice importation was decreasing, wheat flour importation was increasing. The rate of increase from 1910 to 1938 was about 3.8 per cent. The average yearly rice importation was 27.6 kilograms per person from 1903 to 1907, 20.1 kilograms from 1911 to 1915, and 12.9 kilograms from 1916 to 1920 (table 6). Before World War II, the average importation was reduced to about 3.4 kilograms per person. On the other hand, the average yearly importation of flour, which averaged about 2 kilograms per person from 1903 to 1907, was 5.6 kilograms before the war. We had become more of a wheat flour importer rather than a rice importer.

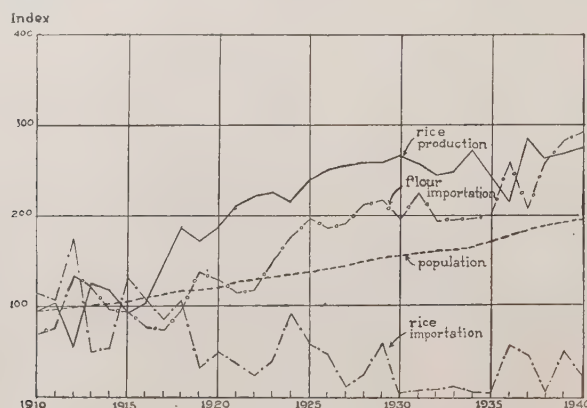


Fig. 2—Index number of rice production, rice and flour importation, and population (1910-14=100).

#### *Growth of human and livestock population*

In 1910 the livestock population of the Philippines consisted of 8,513,800 head of poultry, 1,448,615 hogs, 281,289 cattle, 816,096 carabaos, 150,429 horses, 56,036 sheep, and 234,830 goats (table 7). From 1910 to 1938 the growth in number of the different farm animals was rapid, particularly in the case of cattle, which increased at the rate of 4.9 per cent. The rate of increase was 3.3 per cent for carabaos, 3.2 per cent for horses, 2.8 per cent for sheep, 2.5 per cent for hogs, 2.0 per cent for goats, and 4 per cent for poultry.

In table 7 the different types of livestock, including poultry, were reduced to a common basis in terms of "hog units" to determine the livestock population. In 1910 the livestock population, in terms of "hog units" of all ages, was 8,319,200. In the same year, the human population was approximately 8,219,700. Although the growth of livestock population, which was at the rate of about 4 per cent, had been more rapid than that

of human population (fig. 3), the number of animals was not sufficient to supply even the small amount of meat, eggs, and dairy products consumed by the people.

The livestock industry suffered a radical setback as a result of the last war. According to an estimate<sup>3</sup>, the losses in prewar livestock population are as follows: chickens, 70 per cent; hogs, 62 per cent; cattle, 80 per cent; carabaos, 47 per cent; and horses, 57 per cent. In 1948 the index of livestock population was about 174, or almost the same as that in 1922. It would be necessary to rehabilitate the livestock industry and to develop it faster than before the war.

*Population, land resources, and food supply*

The problem of food supply is closely linked with land resources. While land area remains fixed, population tends to grow. The pressure of popula-

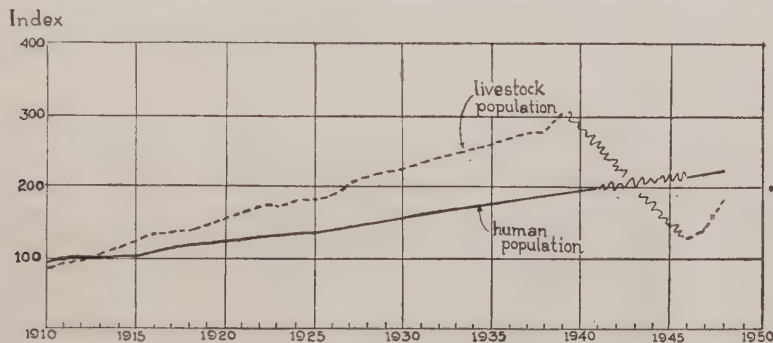


Fig. 3—Index number of livestock and human population (1910-14=100).

tion on the land tends to increase, as has been observed in many countries of the world. In the Philippines, however, we still have an extensive land area available for agriculture. After deducting 14 million hectares of commercial forests and swamps from the total area of the Philippines, there remain about 16 million hectares. Of this area, roughly 7 million hectares are in farms. Of the area in farms, only about 4 million hectares are under actual cultivation. Our problem, in the near future at least, is not lack of land; it is how to raise the low productive efficiency of those who are on the land so that we may have an increased and balanced food supply.

Many authorities believe that in our program of economic rehabilitation and development, much emphasis should be given to self-sufficiency in food. In line with this policy, the government has embarked on a program of increased food production. Special attention has been given to the supply of cereals, which comprise about 40 per cent of our diet. Nutritionists, however, believe that our consumption of meat, eggs, and dairy products is far below the desired minimum. Even before World War II a large per-

<sup>3</sup>GAINES, FRANK S. AND JOSE S. CAMUS. 1940. Agricultural conditions and food prospects in the Philippines. UNRRA Agricultural Rehabilitation Division, Philippine Mission. 34 pp. (mimeographed).

centage of these food items, small in amount as they were, was imported. It appears that in our program of food production, greater attention must be given to livestock raising if we are to produce the foods necessary to an adequate and balanced nutrition.

#### SUMMARY AND CONCLUSION

1. Of the foodstuffs available for human consumption before World War II, about 5 per cent was imported. The supply of foodstuffs in 1947-48 was about 92 per cent of the prewar.

2. We became more dependent upon foreign countries for our supply of food after the war. About 8 per cent of the 1947-48 supply was imported. In the majority of the food groups, there was an increase in the amount imported. The consumption of imported foodstuffs per person rose from about 15 kilograms before the war to 22 kilograms in 1947-48.

3. The Philippines was approaching self-sufficiency in rice when World War II broke out. Rice acreage and production were increasing and rice importation, decreasing. We became more of a wheat flour importer than a rice importer.

4. Our supply and consumption of eggs, meat, and dairy products were very small and far below the desired level. In order to improve the nutrition and, consequently, the health of the people, the country must be able to produce in quantity and kind the foods necessary in an adequate and better-balanced diet. We should pursue a balanced food-production program in which livestock raising is given sufficient emphasis.

5. To bolster up the food supply and raise the food consumption level of the population, our farmers must be able to do either or both of two things: produce more food from the existing area through the adoption of improved methods of production and operate farms of bigger size through the use of better tools and equipment.

TABLE 1  
*Estimated prewar and postwar food supply*

FOODSTUFFS	PREWAR SUPPLY		1947-48 SUPPLY		RATIO OF 1947-48 TO PREWAR SUPPLY
	Per person per year	Per cent imported	Per person per year	Per cent imported	
	<i>kilograms</i>		<i>kilograms</i>		<i>per cent</i>
Rice.....	89.7	3.8	76.5	4.4	85.9
Corn.....	25.2	.4	25.6	.3	103.8
Other cereals.....	5.9	100.0	6.3	100.0	106.8
Total.....	120.8	7.8	108.4	9.0	90.1
Roots and tubers.....	36.6	3.0	30.3	2.3	82.8
Sugar.....	10.8	1.8	11.4	5.8	106.5
Pulses and nuts.....	8.8	.2	8.5	1.0	96.6
Vegetables.....	32.5	5.2	35.0	7.4	107.7
Fruits.....	37.8	.5	32.6	8.0	86.2
Fish products.....	20.3	5.0	22.1	11.1	108.7
Meat and poultry.....	13.9	2.1	8.8	7.3	63.5
Eggs.....	1.6	3.2	1.4	19.1	87.5
Milk and cheese.....	1.9	73.7	2.5	88.0	126.3
Oils and fats.....	2.1	5.4	1.8	3.9	85.7

TABLE 2  
Consumption of imported foodstuffs

FOODSTUFFS	PREWAR		1947-48	
	Total	Per person	Total	Per person
	<i>metric tons</i>	<i>kilograms</i>	<i>metric tons</i>	<i>kilograms</i>
Rice .....	52,366	3.4	63,208	3.3
Wheat flour .....	86,208	5.6	111,309	5.9
Other cereals .....	5,923	.4	8,731	.4
Roots .....	18,138	1.1	12,488	.7
Sugar .....	3,060	.2	13,270	.7
Pulses and nuts .....	269	.02	1,629	.09
Vegetables .....	26,275	1.7	49,204	2.6
Fruits .....	3,295	.2	49,173	2.6
Meat and poultry .....	4,348	.3	12,220	.6
Eggs .....	805	.05	5,179	.3
Fish .....	15,523	1.0	46,773	2.5
Milk and cheese .....	20,981	1.4	42,027	2.2
Oils and fats .....	2,887	.2	1,369	.07

TABLE 3  
*Value of imported foodstuffs*

COMMODITIES	1939-40 <sup>a</sup>	1947 <sup>b</sup>	1948 <sup>b</sup>
	<i>pesos</i>	<i>pesos</i>	<i>pesos</i>
Rice.....	5,788,973	33,544,124	11,400,928
Wheat flour.....	8,971,290	52,136,180	58,953,256
Other cereal products.....	1,760,697	10,430,844	8,969,722
Starch.....	735,511	3,535,530	3,129,644
Dairy products.....	9,044,257	40,735,786	44,469,952
Meat products.....	2,925,801	10,624,410	13,731,928
Poultry and game.....	44,655	280,054	458,626
Eggs.....	670,758	5,210,650	8,410,883
Fish and fish products.....	3,996,604	31,919,136	28,268,876
Fruits and nuts.....	3,048,725	17,495,802	26,843,352
Fruit juices.....	169,633	632,392	901,620
Vegetables.....	4,361,916	15,947,244	17,106,510
Sugar.....	355,796	2,184,496	3,525,952
Oils: animal and vegetable.....	980,606	1,423,806	1,790,135
Coffee.....	1,941,184	11,188,718	13,366,716
Cacao.....	914,033	2,975,140	4,158,460
Confectionery.....	1,082,898	5,109,902	6,152,916
Total.....	46,793,337	245,374,214	251,639,476

<sup>a</sup>From report of the Bureau of Customs for fiscal year 1939-40.

<sup>b</sup>From the Bureau of the Census and Statistics.

TABLE 6  
*Trend of rice and flour importation*

5-YEAR AVERAGE	RICE IMPORTATION	FLOUR IMPORTATION	RICE IMPORTATION PER PERSON	FLOUR IMPORTATION PER PERSON
	<i>kilograms</i>	<i>kilograms</i>	<i>kilograms</i>	<i>kilograms</i>
1903 - 1907	213,088,623	15,371,299	27.6	2.0
1911 - 1915	177,416,916	37,436,776	20.1	4.2
1916 - 1920	129,741,187	36,110,077	12.9	3.6
1921 - 1925	84,115,891	53,548,036	7.5	4.8
1926 - 1930	48,613,288	71,701,937	3.9	5.7
1931 - 1935	11,922,036	71,728,091	.8	5.1
1936 - 1940	59,369,721	92,352,505	3.7 <sup>a</sup>	5.8 <sup>b</sup>

<sup>a</sup>The figure for 1935-39 is 3.4 kilograms.

<sup>b</sup>The figure for 1935-39 is 5.6 kilograms.

Area under rice, corn, coconut, and sugar cane

YEAR	AREA				INDEX (1910-14 = 100)			
	Rice hectares	Corn hectares	Coconut hectares	Sugar cane hectares	Rice	Corn	Coconut	Sugar cane
1910	1,192,140	288,270	164,190	83,170	105	83	77	58
1911	1,043,760	302,520	208,480	120,310	92	87	97	84
1912	1,078,890	340,200	230,680	164,260	95	98	108	115
1913	1,141,240	383,710	223,210	176,120	100	111	104	123
1914	1,244,940	421,510	245,950	169,440	109	121	115	119
1915	1,130,710	443,050	264,150	173,090	99	128	123	121
1916	1,140,830	432,770	270,770	179,760	100	125	126	126
1917	1,225,690	428,290	301,220	185,930	107	123	140	130
1918	1,368,140	418,390	331,390	205,510	120	120	154	144
1919	1,391,340	430,710	368,600	200,200	122	124	172	140
1920	1,484,890	537,130	397,030	197,400	130	155	185	138
1921	1,673,380	543,830	417,960	241,340	147	157	195	169
1922	1,661,430	549,960	444,570	240,820	146	158	207	169
1923	1,675,870	557,690	456,440	227,290	147	161	213	159
1924	1,737,910	533,280	460,440	227,190	152	154	215	159
1925	1,725,500	522,330	472,050	239,470	151	150	220	168
1926	1,755,920	533,570	485,030	231,840	154	154	226	163
1927	1,807,060	561,430	500,010	237,350	158	162	233	166
1928	1,786,960	519,680	515,510	237,000	157	150	240	166
1929	1,775,460	515,040	531,040	257,710	156	148	248	181
1930	1,812,800	516,970	550,840	259,030	159	149	257	182
1931	1,790,610	524,150	561,450	256,180	157	151	262	180
1932	1,781,630	577,130	566,100	253,110	156	166	264	177
1933	1,853,720	629,330	600,700	268,460	163	181	280	188
1934	2,004,030	539,260	608,200	305,890	176	155	284	214
1935	1,964,070	567,420	617,890	211,090	172	163	288	148
1936	2,048,700	685,010	631,980	250,750	180	197	295	176
1937	2,060,960	659,400	637,950	257,060	181	190	297	180
1938	1,912,050	702,530	643,110	227,930	168	202	300	160
1939	1,965,480	860,840	1,051,210 <sup>c</sup>	229,700 <sup>c</sup>	172	248	490	161
1940	2,080,380	912,890	b	b	182	263	b	b
1941	2,289,190	966,920	b	b	201	278	b	b
1942	2,318,560	988,460	b	b	203	285	b	b
1943	b	b	b	b	b	b	b	b
1944	b	b	b	b	b	b	b	b
1945	b	b	b	b	b	b	b	b
1946	1,649,960	571,090	960,000	28,960	145	164	448	20
1947	1,879,600	812,300	960,000	40,990	165	234	448	29
1948	2,026,380	826,490	960,000	82,320	178	238	448	53

<sup>a</sup>Source: Bureau of the Census and Statistics.<sup>b</sup>Data not available.<sup>c</sup>Census of 1939.

TABLE 5  
Rice production, rice and flour importation, population and corresponding index number

YEAR	RICE PRODUCTION <i>cansas of 44 ka.</i>	RICE IMPORTATION <i>kilograms</i>	FLOUR IMPORTATION <i>kilograms</i>	INDEX (1910-14 = 100)		
				Rice production	Rice importation	Flour importation
1910	18,859,090	197,326,220	25,390,848	96	114	71
1911	20,530,100	183,674,708	27,684,107	104	106	77
1912	11,622,470	301,057,276	47,353,497	59	174	132
1913	24,498,860	86,989,555	42,946,612	125	50	120
1914	22,736,810	96,921,497	35,512,856	116	56	99
1915	17,818,490	218,441,545	33,686,807	91	126	94
1916	20,878,860	189,835,577	27,785,337	106	110	78
1917	28,276,720	146,985,715	26,392,782	144	85	74
1918	35,795,050	183,731,531	33,770,057	182	106	94
1919	33,781,650	50,818,758	46,927,449	172	29	131
1920	36,343,810	77,334,352	45,674,758	185	45	128
1921	41,478,540	59,527,817	41,199,605	211	34	115
1922	43,436,830	42,294,888	41,990,857	221	24	117
1923	43,790,500	66,449,039	52,578,938	223	38	147
1924	41,570,700	151,108,793	62,366,462	212	87	174
1925	45,652,600	101,198,917	69,604,320	232	58	136
1926	47,780,000	70,483,920	67,005,993	243	41	187
1927	49,495,400	12,511,280	67,488,635	252	7	189
1928	49,921,200	43,757,326	75,881,252	254	25	212
1929	49,786,400	105,327,046	77,595,086	253	61	217
1930	51,586,900	10,986,866	70,538,720	263	6	197
1931	49,640,300	12,465,128	79,013,252	253	7	221
1932	47,299,200	13,199,719	69,224,672	241	8	193
1933	47,843,000	19,693,594	69,382,020	243	11	194
1934	53,001,200	6,981,733	69,566,739	270	4	194
1935	45,825,100	7,270,004	71,453,768	233	4	200
1936	42,219,600	91,574,177	91,654,925	215	53	256
1937	55,015,730	74,000,968	75,287,549	280	43	210
1938	52,345,210	9,379,191	92,470,865	266	5	258
1939	52,193,430	83,632,976	100,264,130	266	48	280
1940	53,698,780	38,261,272	102,085,055	273	22	285
1941	54,129,940	12,139,624	113,485,305	275	7	317
1942	55,494,000	a	a	282	a	a
1943	a	a	a	a	a	a
1944	a	a	a	a	a	a
1945	a	14,546,218	47,904,627	a	8	134
1946	36,893,940	117,136,174	127,877,992	188	68	357
1947	47,460,000	72,532,495	155,711,496	242	42	435
1948	50,928,480	24,508,376	165,429,102	259	14	462

## FOOD SUPPLY AND POPULATION OF THE PHILIPPINES

217

YEAR	HOGS <sup>a</sup>	CATTLE <sup>a</sup>	CARABAOS <sup>a</sup>	SHEEP <sup>a</sup>	GOATS <sup>a</sup>	HORSES <sup>a</sup>	LIVESTOCK POPULATION INCLUDING POULTRY	HUMAN POPULATION ON JULY 1	INDEX (1910-14 = 100)	
									Livestock population	Human population
1910	1,448,615	281,289	816,096	56,036	234,830	150,429	8,319,200	8,219,700	89	96
1911	1,493,489	306,910	845,300	60,304	253,246	151,477	8,680,200	8,387,200	93	98
1912	1,538,363	332,531	874,504	64,572	271,662	152,520	9,041,500	8,575,700	97	100
1913	1,583,237	371,633	960,717	68,840	290,078	167,358	9,824,200	8,785,500	105	102
1914	1,628,111	426,119	1,063,932	73,108	308,494	179,552	10,755,400	9,016,400	115	105
1915	1,672,985	477,827	1,146,575	77,376	326,910	199,134	11,607,000	9,268,500	124	108
1916	1,717,859	534,214	1,221,254	81,644	345,326	223,325	12,465,200	9,541,700	134	111
1917	1,762,733	567,456	1,228,836	85,912	363,742	203,443	12,651,600	9,836,100	136	114
1918	1,807,607	603,107	1,271,208	90,180	382,158	213,935	13,175,900	10,151,400	141	118
1919	1,852,481	600,173	1,335,443	94,448	400,574	233,978	13,677,800	10,324,000	147	120
1920	1,897,355	678,525	1,388,244	98,716	418,990	255,316	14,535,600	10,445,300	156	122
1921	1,942,229	758,551	1,462,640	102,984	437,406	268,999	15,471,100	10,672,700	166	124
1922	2,028,989	806,186	1,535,955	105,389	419,575	279,345	16,237,300	10,908,400	174	127
1923	2,029,790	808,237	1,541,108	106,612	423,276	277,634	16,303,300	11,152,400	175	130
1924	2,031,988	873,995	1,618,875	111,531	474,248	282,116	17,119,400	11,404,800	184	133
1925	2,064,908	887,841	1,666,407	115,151	428,477	288,430	17,494,700	11,665,500	188	136
1926	2,081,898	916,795	1,705,503	120,869	431,312	294,025	17,919,900	11,934,600	192	139
1927	2,230,864	1,021,169	1,824,899	121,485	445,773	309,184	19,308,500	12,212,000	207	142
1928	2,232,127	1,069,462	1,888,137	133,154	474,725	317,672	19,972,800	12,497,700	214	145
1929	2,381,495	1,096,068	1,915,060	124,722	432,870	333,480	20,466,900	12,791,700	220	149
1930	2,454,286	1,145,921	1,953,964	124,844	452,249	341,169	21,070,100	13,094,100	226	152
1931	2,774,758	1,217,928	2,031,301	128,020	455,700	344,448	22,192,300	13,404,900	238	156
1932	2,491,245	1,282,381	2,149,652	111,670	394,367	319,421	22,676,100	13,724,000	243	160
1933	2,594,620	1,320,980	2,192,904	120,476	433,287	337,669	23,341,200	14,051,400	250	163
1934	2,742,120	1,391,700	2,224,580	127,490	456,050	361,920	24,184,300	14,387,100	259	167
1935	2,880,029	1,407,742	2,245,580	130,014	495,771	381,297	24,668,400	14,731,300	263	171
1936	3,018,758	1,483,260	2,272,319	140,041	518,813	400,250	25,470,700	15,083,700	273	175
1937	3,126,272	1,534,781	2,301,329	151,515	540,537	420,904	26,142,100	15,444,500	280	180
1938	3,183,039	1,549,486	2,349,311	151,814	545,265	435,712	26,623,900	15,813,600	286	184
1939	4,348,515	1,349,264	2,918,730	37,653	402,173	340,433	29,011,300	16,151,600	311	188
1940	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	16,458,600	<i>b</i>	191
1941	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	16,771,400	<i>b</i>	195
1942	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
1943	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
1944	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
1945	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
1946	1,460,780	443,530	1,388,870	19,030	182,730	151,260	11,900,000	18,426,900	128	214
1947	1,752,930	485,620	1,504,450	20,620	210,780	157,390	13,149,100	18,777,100	141	218
1948	2,636,820	613,270	1,715,530	25,950	277,900	183,290	16,199,600	19,134,000	174	223

<sup>a</sup>Source: Bureau of the Census and Statistics; number of poultry: 1903 — 5,564,599; 1918 — 11,792,474; 1939 — 26,128,962.<sup>b</sup>Data not available.

## COLLEGE AND ALUMNI NOTES

In the one-hundred-and-eighty-seventh scientific meeting of the Los Baños Biological Club on October 28, 1949, the following papers were read and discussed: "Castration and Docking with the Use of Rubber Band" by Dr. Valente Villegas, of the Department of Animal Husbandry; and "Equilibrium Moisture of Copra at Various Relative Humidities" by Dr. J. Banzon and Mr. A. D. Bustrillos, of the Department of Agricultural Chemistry.

In the one-hundred-and-eighty-eighth scientific meeting on November 25, 1949, Mr. Felix O. Chinto, of the College of Forestry, read a paper on the growth and development of gubas, a matchwood species.

In the one-hundred-and-eighty-ninth scientific meeting on December 23, 1949, Dr. Leon G. Gonzalez, head of the Department of Agronomy read: "The Possibilities of Rambutan for Canning and a Comparison of the Product with Canned Litchi".

In the one-hundred-and-ninetieth meeting on January 27, 1950, Professor Calixto Mabesa, of the College of Forestry, read: "Modifications in the Construction of a Japanese Oven".

In the one-hundred-and-ninety-first scientific meeting on February 24, 1950, Dr. Mariano Mondoñedo, of the Department of Animal Husbandry, read: "Does Hog Raising Pay?"

Dr. Manuel L. Roxas, '11, heads the group making a study of the rehabilitation and improvement of the Philippine sugar industry. He is assisted by a staff composed of Messrs. Salvador B. Oliveros, '33, Alfonso E. Briones, '29, and Pablo C. Enrile, '38.

Mr. Burton T. Oñate, '47, U.P. fellow at the University of Chicago, has been elected president of the Filipino Association in Chicago.

The faculty, at its meeting on November 14, 1949, approved to recommend to the University Council the graduation of the following students who completed the requirements for the degree of Bachelor of Science in Agriculture: Rizal A. Afenir, Eleuterio H. Aguas, Bernardino Q. Ballesteros, Florencio S. Caguica, Juan B. Callejo, Domingo B. Carnate, Teofilo S. Eugenio, Clemente P. Juliano, Jr., Jainari S. Kibitiani, and Manuel Q. de Leon, Jr.

Valentin G. Cedillo, '42, and Francisco T. Ramos, '49, completed the requirements for the certificate in Agricultural Education.

The graduation of Felipe O. Ledda and Felino B. Rivera for the title of Associate in Agriculture was also approved.

The College has an enrollment of 326 students in the second semester of the school year 1949-50, or 46 less than the first. In the Rural High School, 166 students are enrolled, or 10 less than the first.

At the faculty meeting on November 14, 1949, the following courses were instituted: For regular students, Agricultural Botany 102, Plant

Growth; Agricultural Botany 108, Plant Enzymes; and Agricultural Economics 8, Agricultural Geography. Soils 102, Soil Fertility and Fertilizers, was divided into two courses, Soils 102a and 102b. For students working for the title of Associate in Agriculture and teachers of secondary agriculture who attend the summer institute the following new courses were approved: Agronomy 13A, Cereals and Other Annual Crops; Agronomy 20A, Fruit Growing; Agronomy 25A, Vegetable Gardening; and Agronomy 29A, Perennial and Industrial Crops.

The Mimes-Mummers-Scribblers, the Soil Tillers' Photographic Club, and the Associated Women Students donated P25, P10, and P10, respectively, to the College of Agriculture Students' Emergency Loan Fund. Donations to this fund will be appreciated.

Messrs. Francisco G. Galang, '14, chief of the agricultural extension division of the Bureau of Plant Industry, and Francisco C. Pañaniban, '24, assistant agronomist in the same bureau, are the authors of *Agricultural Extension Service Handbook*, which is Technical Bulletin No. 19 of the Department of Agriculture and Natural Resources.

Three seniors who recently completed the requirements for graduation from the College have been appointed graduate assistants. They are Mr. Bernardino Q. Ballesteros, Department of Agricultural Botany; Mr. Teofilo S. Eugenio, Department of Agronomy; and Mr. Clemente P. Julian, Jr., Department of Agricultural Engineering.

On November 26, 1949, officials of the U.S.-Philippine War Damage Commission, accompanied by President B. M. Gonzalez and Dean L. B. Uichanco, inspected the newly reconstructed buildings financed with war damage funds. They were highly satisfied with the work accomplished under the supervision of the superintendent of construction, Professor Andres P. Aglibut. The other constructions under way and expected to be ready at the opening of the school year 1950-1951 include one large dormitory for students, four bungalows, and the mess hall.

In the second semester, 1949-1950, the following students qualified for College scholarship: Pedro B. Escuro, (Bailon de la Rama Scholar), Ibarra S. Santos, and José O. Juliano (Bailon de la Rama Scholar). The students who did not qualify for College Scholarship but made the honor roll were: Bernardino Q. Ballesteros, Reynaldo G. Marquez, Thomas G. Flores, Quintin de la Torre, Jorge P. Juliano (Madriral Scholar), Jesus C. Alix, Alfredo L. Eloja, and Jainari S. Kibitiani.

In the symposium on soil conservation held in Manila on December 16-17, 1949, Dean Hilarion S. Silayan, '17, executive secretary of the PAC-SA, presided at the December 16 meeting and Dr. Manuel L. Roxas, '11, director of the Sugar Experiment Station, was one of the speakers at the December 17 session. Messrs. Dominador Z. Rosell, '28, Juan B. Cabanos, '19, Fernando de los Reyes, '35, and Ignacio R. Ang, '32, are among the officers of the Soil Science Society of the Philippines.

Two alumni of the College are members of the lower house of Congress, which is at present holding a regular session. They are Congressmen Eulogio Rodriguez, Jr., '25, of Rizal, and Dennis Molintas, '34, of Mountain Province.

Dean L. B. Uichanco, '15, and Demetrio S. Santos, '36, president of the Philippine Association of Agriculturists, were appointed by the Board of Directors of the National Development Company members of the special committee which conducted an investigation of the work of the Rice and Corn Production Administration.

Mrs. Victoria Mendiola-Ela, '30, was appointed assistant instructor in plant pathology, effective January 3, 1950. She served in this capacity before the war.

President Arthur L. Carson of Silliman University and Fulbright exchange professor Leland E. Call of Kansas State College, at present teaching in Silliman University, conferred with Dean Uichanco and other members of the faculty on January 17, 1950, regarding their plan to offer a two-year curriculum in agriculture, which may be accepted by the College as equivalent to the first two years of the four-year curriculum. Under this arrangement, graduates of that course from Silliman can be admitted to the regular junior year in the College.

## THE EXPERIMENT STATION

---

### LIST OF AVAILABLE CIRCULARS AS OF JANUARY, 1950

- No. 2.—Bud Rot of Coconut..... *By G. O. Ocfemia*
- No. 8.—Horse Breeding in the Philippines..... *By V. Villegas*
- No. 10.—Practical Directions for Coffee Planting  
(Revised by Charles Fuller Baker, Dean,  
College of Agriculture, 1917-1927.)..... *By Pedro A. David*
- No. 11.—The New College Copra Drier—Prepared in  
the Department of Agricultural Chemistry  
with the cooperation of the Department of  
Agronomy and Extension. (Revised)..... *By Moises M. Kalaw*
- No. 17.—College Trapnest..... *By F. M. Fronda and P. S. Paje*
- No. 18.—Surveying for Area with a Surveyor's Staff.. *By Alexander Gordon*
- No. 23.—Curing Pork and Making Sausage for  
Home Use..... *By Mariano Mondoñedo*
- No. 24.—Construction and Operation of Silos in the  
College of Agriculture..... *By J. P. Esquerra*
- No. 26.—Training Cattle and Carabaos for Work.... *By Valente Villegas*
- No. 28.—Cotton Culture..... *By Eulalio P. Baltazar*
- No. 29.—Collegiate Education in Agriculture..... *By Leopoldo B. Uichanco*
- No. 30.—What Should Filipino Ornamental Gardens  
and Ornamental Plants Be?..... *By N. B. Mendiola*

The price of the circulars listed above is thirty centavos (₱0.30) each.

---

ALL ORDERS WITH PAYMENT SHOULD BE ADDRESSED TO THE  
BUSINESS MANAGER, THE PHILIPPINE AGRICULTURIST,  
COLLEGE, LAGUNA, PHILIPPINES.

## SWORN STATEMENT

(Required by Act No. 2580)

The undersigned, business manager of THE PHILIPPINE AGRICULTURIST, published quarterly in English at the College of Agriculture, College, Laguna, after having been duly sworn in accordance with law, hereby submits the following statement of ownership, management, circulation, etc., which is required by Act 2580, as amended by Commonwealth Act 201:

*Editor:* Dean L. B. Uichanco, College, Laguna, Philippines.

*Managing Editor:* Dr. G. O. Ocfemia, College, Laguna.

*Business Manager:* Dr. J. M. Capinpin, College, Laguna.

*Publisher:* College of Agriculture, University of the Philippines, College, Laguna.

*Printer:* McCullough Printing Company, 1104 Castillejos, Quiapo, Manila, Philippines.

*Owner:* College of Agriculture, University of the Philippines, College, Laguna, Philippines.

*Owners or stockholders holding one per cent or more of total amount of stock:* University of the Philippines, Diliman, Quezon City, Philippines.

*Bondholders, mortgagors, or other security holders owning one per cent or more of total amount of securities:* None.

*Total number of copies printed and circulated, August, 1950:* 980.

J. M. CAPINPIN  
*Business Manager*

Subscribed and sworn to before me this 16th day of September, 1950, at Los Baños, Laguna, the affiant exhibiting his Residence Certificate No. A3842052, issued at Los Baños, Laguna, on January 3, 1950.

AURELIO C. ALMASAN  
*Municipal Mayor*  
*Los Baños, Laguna*